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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Breniser's Continuous Acting Ratchet Drill and Adjustable Knee.

The engraving represents a new ratchet drill and knee, embodying the following valuable features: A continuous advance of the drill is obtained with both the forward and backward motion of the handle, thus performing twice the amount of work in the same time as an ordinary ratchet drill.

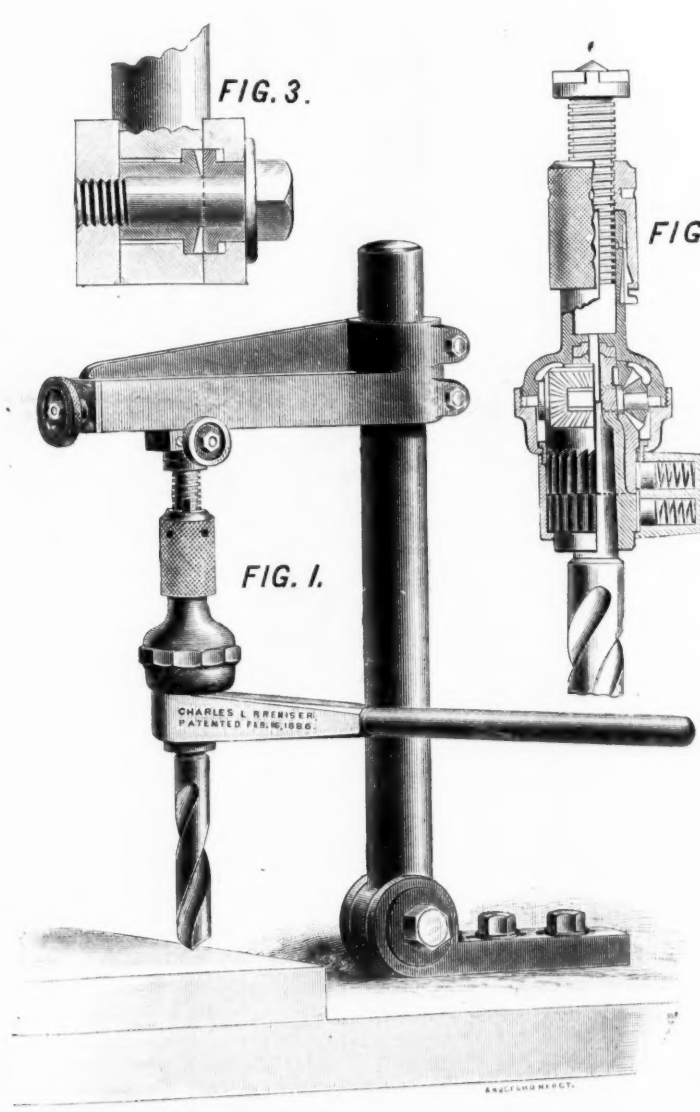
All working parts are entirely encased, thereby keeping them free from dirt and grit. It is constructed on thoroughly mechanical principles, and is in every respect a strong and reliable tool. The hand nut affords ample means, of feeding up to one inch drill. Above this size a pin or spanner can be used.

The knee (or "old man," as it is sometimes called in shop parlance,) is adjustable in every direction, and is perfectly rigid in all positions. The center, which supports the end of the ratchet screw, is moved the entire length of the arm by a hand wheel at the end of same, and has a cross motion to facilitate accuracy in setting not possible by the old method, thereby saving the end of the screw many severe raps with the hammer to square up the work. The hinge joint in the base, as shown in Fig. 3, is made with a V toothed clutch, with one member keyed fast to the post, and the other fastened by a spline to the jaw of the base. By slacking the hinge bolt and pressing on the post the clutch ring is pressed back into a recess provided for it, thereby permitting the post to be moved to the required angle. Tightening the hinge bolt presses the clutch into gear and also clamps the jaws of base to the post, and locks them firmly. This knee can be used equally well with an ordinary ratchet or Stow flexible shaft.

The hand-nut and screw can be instantly removed by pressing on the spring, shown in Fig. 2, under the hand-nut, when the drill can be extracted by driving a drift or pin in the end of the spindle.

The casing is parted on a line with the center of idler pinions and supports the ends of yoke carrying same.

This tool is very compact, being no larger than an ordinary ratchet of the same capacity. It is the invention of Charles L. Breniser, Johnstown, Pa.



BRENISER'S RATCHET DRILL AND ADJUSTABLE KNEE.

The Compound Steam Engine for Stationary or Factory Purposes.

BY WILLIAM H. HOFFMAN.

SECOND PAPER.

In leaving the question of steam jackets for future consideration, I will simply say that my method has been to jacket both cylinders, first leading the steam to the high pressure cylinder jacket, thence to the low pressure cylinder jacket, through a small pipe and convenient regulating valve. The pressure in the high pressure jacket, will be the same as the boiler pressure, but the pressure in the low pressure jacket, is regulated to suit the initial pressure at the low pressure cylinder, steam being cut off at an average of $\frac{1}{4}$ of the stroke, the boiler pressure ranging from 80 to 95 lbs. The results were satisfactory.

Among hundreds of factory and mill engines in the several manufacturing States, there are very few that are working on the compound system.

The cost of the compound engine has much to do with its present limited use, but manufacturers using large powers, say from 300 to 1,200 horse-power, would in all cases adopt this type of motor, if the past results as to consumption of fuel had been satisfactory. There is a compound engine in one of the Eastern States, built on the plan of placing the two cranks at right angles on the main shaft, that was in operation about one year, and during that time, was developing daily 600 horse-power with a consumption of over $3\frac{1}{4}$ lbs. of coal per horse-power per hour.

A pair of plain condensing engines are now doing this work on $2\frac{1}{4}$ lbs. of coal per horse-power per hour. The compound engine had an independent air pump and condenser combined, this being now used by the plain condensing engine, so there was no reason for any more friction on the compound, than there was on the plain engine.

Now *one* of the reasons for the complete failure of the compound system in this case, was a badly arranged steam jacket. This engine is now used only in case of an emergency, as it requires more fuel to operate it, than any of the old automatic *non-condensing* engines on the same plant, using steam from the same boilers.

There have been several similar failures with the compound system, and some of the largest mill owners ignore the claims for this method of using steam, when asking for proposals. This should not, and would not be so, if correct proportions and economical design had been the rules in the construction of these engines.

Engines for driving cotton, woolen, flax, and silk mills, must have steady and uniform rotation for the main shaft, in order to do this work well, and since high rotative speed has been introduced in many of the large spinning mills, much better work and more of it has been done. Factory engines, making from 45 to 65 revolutions per minute, have from 90 to 130 center or turning points per minute, while the high speed spinning engine divides this time into 300 turning points, and has as a rule increased the piston speeds at least 200 feet per minute, thus making a great saving in fuel, by lessening the cylinder condensation. The steam motor having a high rotative speed, imparts a perfectly uniform and steady tension to the bands on the spinning frame, and consequently the spindles run with little or no variation of motion. This result insures the production of yarn of an even size, and at least ten per cent. more in quantity than the slow speeds.

A compound engine should have high rotative and piston speeds, the proper number of revolutions being from 90 to 250 per minute according to size of engine, and the piston speed should never be less than 550 feet, and from that to 850 feet per minute.

An engine thus designed will give a better speed to mills than a *pair* of engines running at the slow speed with cranks at right angles. By placing the pistons both on one piston rod, and one cylinder behind the other, when horizontal, and above the other when the vertical type is used, we have the compound engine in its most economical form, considering the first cost, and daily consumption of fuel.

With this single crank compound engine, no receiver is required, and the steam jackets can be arranged in a simple and efficient manner.

Some of the most economical marine engines now in operation are on the Western Lakes, and are of the compound style, two pistons on one rod, the high pressure cylinder being above the low pressure. Some of these engines are producing a horse-power *regularly* with less than two lbs. of coal per hour, this being an average of a month's run. A twenty-four hour test on one vessel showed $1\frac{68}{100}$ lbs.

Twist drills 4 inches in diameter are now made. They are used in coal mining machines. A gang of these huge drills is forced into the coal at the bottom of the pieces it is desired to remove. The drills are placed so near together that they cut a continuous channel. Two more cuts are then made, one at either end of the first cut, and perpendicular to the same. Three sides of a block being thus set free, a single hole is drilled at the top of the block of coal, and a charge of powder being fired therein, dislodges the whole mass.

Railroad Shop Notes.

The New York Elevated Railroad shops on 93d street are as busy as ever, employing now about 350 men in the various departments. They have 239 locomotives, and the checkboard showed, when we called last week, that eighteen were in the shop for repairs; six were classified as fair, seven as bad, one in reserve and the rest good. Twenty-five locomotives are being built at Rome, N. Y., for the elevated road, and one is under construction in the shops at 93d street. These are all of the Forney type and have extended smoke-boxes and straight stacks. All burn anthracite coal. As fast as locomotives are repaired they are fitted with sheet iron cabs, which are no heavier than wooden cabs and give no trouble to keep in repair. Besides, they look fully as neat as wooden cabs, when painted. All the new locomotives are to have iron cabs. A locomotive thus improved has no wood about it except the lagging on the boiler. All locomotives and cars are built from the company's drawings. All parts are made to standard, bolts, nuts, oil cups, and in fact all

parts that are liable to give out are kept in stock in the shop so they can be supplied ready for use upon the shortest notice. Packing rings are kept in six sizes to correspond with different degrees of wear. The shops are fitted with the best tools and every workman has a distinct job to perform, which he continues upon until finished. The careful subdivision of labor has much to do with their getting out work promptly and accurately. The store houses, which has three floors, is well stocked with waste, shovels, brooms, oil, and a hundred other things used on the road. We were informed that but one month's supplies are kept on hand. The remarkable immunity of the elevated road from mishaps when running, is largely due to the close system of locomotive inspection carried out at the shops. The requirements are much more exacting than upon a surface road. Nothing must be permitted to get loose and drop into the street. Special inspectors examine every engine daily, and they become expert in detecting any weak spots. Five-car trains are now being run during busy hours, and the increasing passenger traffic adds to the necessary work in the shops in keeping the rolling stock in good order.

The car and locomotive repair shops of the Chicago & Northwestern Railroad, in Chicago, are about the most extensive of their kind in the West. They consist of nineteen brick buildings and thirty three frame buildings, all arranged upon the prairie so as to be most convenient to each other in the transferring of work, also providing for enlargements. The largest building is the locomotive shop 120x552 feet. When we visited these shops recently, thirteen locomotives were being repaired. Some of their locomotives are being fitted with extension smoke boxes and straight stacks. Notwithstanding the complaint of dullness (which prevails in most railroad shops just now), they are employing 1,500 hands nine hours a day.

The Northwestern road prints an annual descriptive list of their locomotives, a copy of which was handed us by W. A. Scott, Assistant Superintendent of Motive Power and Machinery. It is in the form of a neat morocco covered book for the pocket. Each engine is designated by its number. The particulars given, embrace diameter of cylinders, stroke, number of driving wheels and their diameter, driving wheel base, total wheel base, length of fire-box, width of fire-box, weight of engine, weight on driving wheels, when built or rebuilt, and maker's name. This road probably has more locomotives than any other in the United States. It has 681 no / in use and thirty more are building. Five will be broken up, leaving, 706 for service. G. W. Tilton, the Superintendent of Motive Power and Machinery, says it is cheaper to buy locomotives than to build them. They have not built any new work at these shops for three years. They have all locomotives built from their own designs (except a few ten wheel Schenectady engines) and even furnished patterns for the first lot ordered from one establishment. They put their monthly locomotive reports in print, making three large sheets, giving details of the work done and expenses of each engine. A small sheet is also printed summarizing the whole.

The Sleeper piston packing is being applied to locomotives at the rate of ten a month.

In the car shop we noticed two new business cars nearly completed, one for the Omaha railroad and the other for branch of the Northwestern. They are of new designs and are finished inside very tastefully in bird's-eye maple and cherry. The natural wood finish surpasses any painted surface in attractiveness. We also noticed a new design of Pullman sleeping car, which has the most comfortable seats we ever saw in a car. The seats are high, elegantly upholstered in old gold brocaded plush, and are made to conform to the back with a head rest. The panel work is veneered with pieces cut and set in. The car has fourteen sections, is finished in mahogany with beveled mirrors, and runs on 33" Allen wheels.

The London *Ironmonger*, of April 3, has a special article complaining about the successful competition of German and American machinery for mills. It says:

"It is understood that during the last three years something like £3,000,000 sterling have been expended by the millers of the United Kingdom in having their mills transformed from the old to the new system, and of that large sum at least £1,500,000 have gone into the pockets of German and American engineers, even at a time when the engineering trades of this country were in a very stagnant state. The improved mills of Glasgow and Liverpool are to a large extent filled with German-made machines, while the trade in wheat-cleaning machinery is almost entirely supplied by Germans and Americans.

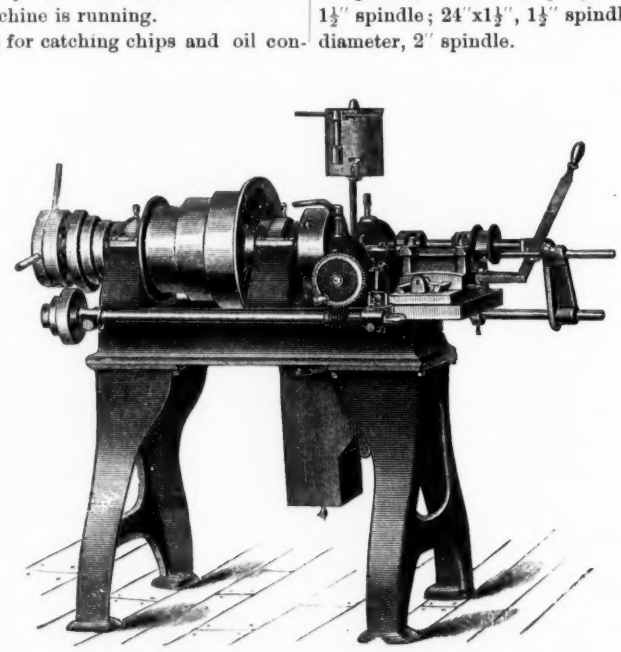
* * * * *

"During 1885 the imports of manufactured goods declined about £90,000, and this decline is partly traceable to the falling off in the imports of the American milling machines."

Two-Inch Cutting Off and Centering Machine.

With this machine two tools are used for cutting off the stock, one pressing up and the other down, thus steadying each other, and relieving the strain. One of the tools is ground **V** shaped, and being set slightly in advance of the other cuts out the stock at the center of the cut. The construction of the nut for the back tool block enables the operator to make that tool block independent at will, and to adjust the two tools to cut alike when the machine is running.

The device for catching chips and oil consists of a hinged receptacle under the machine, in which the oil is drained from the chips, which can then be dumped dry—a matter of convenience and economy.



Two-Inch Cutting Off and Centering Machine.

The centering attachment runs with a separate belt, and the work revolving while being operated upon, the centers is accurately done. The socket for drill or countersink is "Morse" taper. Provision is made for adjusting the centering attachment to the center of the machine, should the alignment be disturbed by wear. Automatic feed and throw-off are provided. Tight and loose pulleys are furnished with the countershaft, unless friction clutches are preferred.

The manufacturers are Hurlbut & Rogers, South Sudbury, Mass.

Emery Wheels and their Uses.

By L. Best.

The uses to which emery wheels are being put are rapidly increasing every year, and where they were considered expensive and unnecessary experiments a few years ago, they are now generally used both for regular and special purposes, and are being used much more intelligently. Yet there are many shops where the emery wheel occupies the place so long filled by the grindstone; no one seems to care what treatment it receives, what it is used for, and what condition it is in, and while many attempts at grinding on it are made, but very little real work is accomplished, when if it were properly cared for and kept true it would become an invaluable tool in any shop.

In ordering an emery wheel, be sure you know for what purpose it is to be used, and if you are in doubt about it doing all kinds of work for which you wish it, then order a wheel for each purpose, which will be the cheapest arrangement in the end, and your grinding will be better done.

Run your wheels on substantial machines set on a solid floor, and when the machine is heavy, when practical, place it on a solid masonry foundation. If more care were exercised in this direction, fewer wheels would break, as the continued jar and vibration caused by running wheels on light and cheap grinders on shaky floors, would be done away with. Many emery machines are made to sell and not for long use, and when a manufacturer thinks he is saving money because he buys one of these frames at a lower price than he would have to pay for a good one, he is mistaken, as they soon get out of order and then it is impossible to do good grinding on them, no matter how good your wheels are.

Don't run your wheels on small arbors; no harm can be done by having them large. I have seen an 18"x2" wheel run on an inch arbor when it should have been 1½ inch. The following rule is a good one to adopt: Run wheels 4" diameter and under, on ½" spindles; 5" to 10", ¾" spindles; 12" diameter, 1" spindle; 14" to 16", 1¼" spindle; 18" to 20" 1½" spindle; 24"x1½", 1½" spindle; 22" to 26" diameter, 2" spindle.

Have your machine fitted with suitable rests, and as the wheels wear away, move them up close to the face of the wheels; it is no unusual sight to see the grinder at work on a wheel with the rest so far from it, that if the casting he is grinding should get out of his hands (which frequently occurs) it would certainly drop between the wheel and the rest, the result would almost invariably be a broken wheel and an injured workman, but all the public would hear would be: "Another emery wheel bursted without any apparent cause, seriously injuring the operator."

Have the wheel slip easily on the mandrel; do not force it on in any case, as the expansion of the spindle in case of heating in many cases causes the wheel to break.

Run your wheels between flanges at least ¼ or ⅓ their diameter, and do not screw the flanges up against the sides of the wheels too hard, but only tight enough to prevent slipping, and see that both are concave, and fitted with thin rubber or leather washers between the flanges and wheels.

In grinding on a wheel be careful not to bear on in any one place all the time, but keep the work moving constantly back and forth across the face of the wheel. This is important, as you wear your wheel evenly, prevent heating, keep a better cutting surface, and allow the use of a harder wheel.

Do not crowd the work against the wheel hard, trying to force it to cut, as it will cut faster when only a moderate pressure is applied, keep cooler, and last longer. Keep your wheels true by using a dresser or black diamond. In a previous issue of the American Machinist I have fully described their use. Do not place much reliance on a wheel that can be trued up with a piece of copper tubing or wrought iron pipe, especially where rough or hard grinding is to be done.

In ordering a wheel, state if you prefer a soft or hard one. Some manufacturers want a wheel to last for years, not seeming to care how long it takes to do a certain amount of work so long as the wheel is saved, while another thinks the longer time it takes his men to grind on a hard wheel in the end costs more than the few dollars he saves in his emery wheel bills, and consequently orders softer and faster cutting grades.

Don't put the poorest mechanic and cheapest man you have in the shop to work on your wheels, but realize that the work an emery wheel does is important, and it should no more be worked by a cheap man than the most expensive tool you have.

Run your wheels at the speed named by the maker, and do not increase or decrease the speed and still expect them to suit your work. Still, for certain classes of work wheels should be run at different speeds. A 24"x1½" wheel on an automatic planer-knife grinder should be run at only about 300 revolutions per minute, when for ordinary work twice or three times this speed is used. Much doubt usually exists in most shops as to just what speed their wheels are running, and as this is very necessary to know, a small speed indicator, which can be had at a trifling cost, should be in every shop. Do not expect too much from one wheel, but get one for every class of work.

Keep the emery machine and wheel in as good order as the best engine lathe you have, for surely it has as hard and important work to do, especially when you grind hard tempered tools or chilled iron, and still they are looked upon as any one's property and generally neglected, and the small care of oiling the bearings is left until they begin to heat.

Where feasible, have only one man do the grinding. When any of the men have a tool to grind let them take it to him, for if you allow every man in the shop to run to the emery wheel and try to sharpen a tool they will get both the wheel and tool out of shape.

With about 20 varieties of wheels in the market, and some of them very good ones, it seems that the user ought to be able to get those suited to his work, and it is well to note that no one variety will suit all classes of work, so that in a shop where different classes of grinding is done, several makes of wheels are used. The one first put on the market cannot be equalled on several kinds of work by any other wheel and so with several others since brought out.

Corundum has of late years been quite extensively used in wheels for several classes of work, and for brass finishing, chilled roll grinding, surface work, sharpening woodworking tools and machine shop tools is better than emery, and is so much called for that many of the wheel manufacturers are using it quite largely; at one time several makers claimed to be the only users of corundum, which was not a fact, for it is made up in wheels for some classes of work by nearly all manufacturers.

Wheels for running in water are now much thought of, particularly for grinding tempered tools, and are fast replacing the old-fashioned and cumbersome grindstones, which have so so long been a nuisance in many shops. Several machines are now on the market, so arranged that the wheel has the face sufficiently exposed to do all classes of grinding, and yet covered with a hood to prevent the water spattering, and while they grind a tool much faster than a grindstone, the work they do is much more accurate and a better cutting edge is the result. As yet tool grinding, chilled roll and wood pulp grinding are the principal purposes for which emery and corundum wheels running in water are used, but they must ultimately drive out grindstones on nearly all classes of work, the chief objection to them at present being that they

cannot be made large enough. But where they have been used the results have proved that they cut from two to three times faster than a grindstone, are cleaner, give less trouble, besides proving cheaper in wear. I have a case in mind where a 24x4″ emery wheel, No. 20, has out-worn twenty 36x6″ grindstones, while it has not itself worn down an inch yet, and at the same time cuts twice as fast.

While the increasing manufacture and use of improved labor saving tools and machinery goes on, the intelligent and appreciative mechanic cannot fail to see that the use of emery wheels must take an important part in reducing the cost of production, to meet the sharp competition now prevailing, and he also knows how far behind those are that refuse to invest in new tools and proper appliances; it can therefore be confidently predicted that manufacturers must, by necessity, soon see how valuable an emery wheel adapted to the work and properly operated becomes, and it will be a matter of only a very few years when the amount of work a wheel does will be more closely calculated, the results attained better known, and their use will be extended into branches of manufacturing where they are at present comparatively unknown.

Making Gear Patterns.

BY F. W. BARROWS.

FIRST PAPER.

We sometimes get the whole design to work from; then we have smooth sailing, because we have comparatively no responsibility beyond what we have in the construction of all patterns. When we have given us the pitch, number of teeth, and are expected to furnish the rest, if the casting comes out right the "boss" gets the glory, and if it doesn't come all right we must shoulder the blame. Isn't that about the way it works?

As we always find out the size of tooth first, we have that to start on. Now let us make the rim with a section equal to section of tooth at pitch line. Give it plenty of draft (one side must cope out, you know), and add the rib inside rim, shown by Fig. 22 in section. The arm I should make straight and with a rib on each side, having a smaller section than the rim, Fig. 23; then let the arms taper to a size at the hub that will give them the same strength in proportion to the strain as the outer end of arm. The arm is to be of the same thickness as rib shown inside rim.

The edges of arms and the rib inside rim are not rounded, but the section shows a point. This gives the moulder a guide for the parting, and the casting will look better than when the moulder puts on this edge.

Commence with the rim, so regulating the thickness of courses as to have a joint come up to the top of arms. After this course is on, turn up the rib as near the finish as possible. In the time between courses, and as it is best to wait for the glue to dry, and not use nails, right here let me say that it is nearly always possible to wait for the glue to dry in laying up courses.

There is on most jobs other stuff to get out. If your glue is right and the weather is right, you need not wait over thirty minutes for any job. I have faced off a course that had been on only ten minutes, and didn't put any nails in the glue either. Next get out the arms.

If the arms are pretty heavy and of an even number, and you think best, you may lock them together. I wouldn't do it, for I don't think it any improvement, unless it is a case where it is impossible to fasten the hub on one side. I should butt the arms together, glue them and screw fast to lower side of hub. Cut them into rim, leaving enough wood outside the ends to make it substantial.

I know that some may object to putting in the arms permanently, for the reason that they may wish to put in a heavier or a lighter set; but if the arms are properly proportioned, they are not only the most suitable size compared with teeth, but are also of the right size to make a good casting. If they are made larger or smaller, there will be a strain that will tend to weaken it, and perhaps draw it out of shape.

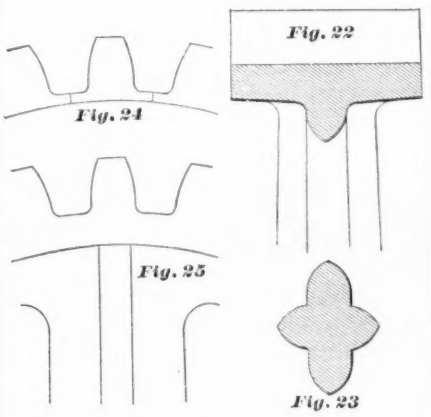
Better make the arms straight. Crooked arms don't look as well, and are not as strong. Some set the arms as tangents to the hub. This, they say, gives them a chance to relieve the strain of unequal shrinkage by twisting the hub. The arms may be straight, and the shrinkage won't hurt them if they are made by a good moulder. If the arms don't come full up to the top of last course, fill up the space with wood, then finish gluing up the rim.

In turning the rim, be careful not to cut the arms half off, because it would weaken them, and don't re-chuck your wheel until the teeth are fastened on.

We are now ready to put on the teeth and will make up our minds as to how we do it. The oldest way perhaps is to put in dovetails and the best I can say for this method is that we should always respect age. We are not obliged to do as our fathers did. I know of one firm that uses a good deal of gearing and they wont have any dovetails. They say that it takes too much time, besides it is liable to spring the rim. I agree with them as to the expense and I would just as soon have them put on in some cheaper way. In fact, where it is possible, I would just as soon have them put on solid with glue.

I presume the idea of using dovetails was originated to overcome the difficulty of drawing the teeth all together. If one tooth stuck the moulder could draw it by itself.

If you had made your wheel so that the teeth were not parallel with each other the moulder would be able to draw them one at a time in different directions as circumstances demanded, and so he would be able to mould your wheel. As to the value of casting, I won't say, because the pattern maker might be near. Again, if the pattern maker is competent to make a pattern so that the teeth and dovetails are in line, isn't he capable of making the whole wheel so that it will draw all together?



Perhaps it will take a little longer to work them if they are glued fast, but it will save time on the whole. I can work the teeth about as quickly as I can put in the dovetails. If they are glued on it holds the fillet at root of tooth. Another way to save this fillet is to put them on like Fig. 24, using dowels and screws.

I have put on teeth with screws alone. If you should try this way, don't forget to mark with a knife across the tooth and rim at each side of wheel before taking them off to work, and you will need to be very particular in replacing them or you will destroy the spacing.

I should use two dowels and one screw for anything under 6″ face; above that use more screws. Somewhere I have read or heard about working teeth in long strips, cutting them up to length and nailing them on. This method is only excelled by the man who saws them out of the solid wheel and finishes them with sand paper. Both ways might suit some people. There is no accounting for tastes.

Having the teeth fastened on, finish trimming and mark the pitch line. Don't make a line a sixteenth of an inch wide, but first get a good surface by means of shellac and sandpaper. Then, using a fine, sharp point, make a line as fine as possible, taking your eyesight into consideration. If you want a line for centers make that also in the lathe.

Machine Shop Photography.

BY JAMES F. HOBART.

Photography, as stated in a recent editorial, is capable of a great many applications which will benefit the machine manufacturer, seller and user.

All manufacturers are aware of the use of photography for the purpose of securing engravings of machines, but a very limited number know of the many uses to which the camera might be put, were it an every-day shop appliance.

Let us fit up an imaginary gallery in a machine shop, and see the result.

First, we must decide what size of camera we will purchase, and, in order to do so, must determine what size of pictures we shall be likely to want.

With the larger sizes of photos—say, from 8″×10″ to 20″×24″—we will have nothing to do, but confine ourselves to sizes under 5″×8″.

For the purpose of effecting sales, a 4″×5″ picture is as good as one 10″×12″, and the cost of making such pictures is much less than that of larger sizes.

A 5″×8″ camera is a convenient size for shop use, and, as a small picture can be made in a large camera, this size will allow us to make 4″×5″ and $3\frac{1}{4}$″×$4\frac{1}{4}$″ negatives for the smaller machines, and still be able to make a 5″×8″ picture of a large machine, or a large view of a small tool.

The purchase of a suitable lens should be intrusted to some one who has a knowledge of photography, and any reputable dealer in photographic goods will make a choice upon being informed of the work which is to be done.

For machine photography a lens must be one that will give a straight picture of a straight line. Some low-priced lenses will distort figures, especially when near the edge of the plate, by making straight lines appear more or less curved toward the circumference of a circle, of which the middle of the plate may be taken as a center.

A picture can be taken with almost any lens. The objective, or large lens from an ordinary opera glass, will give a very good picture; spectacle and eye-glass lenses will give fair results where straight lines are not necessary, and even a lens may be dispensed with altogether by drilling a very small hole in a piece of metal or cardboard, and using it as a lens.

Having secured a camera and lens, a "dark room" is the next requisite.

Any convenient closet may be utilized, or a corner of a room may be partitioned off for this purpose. The requisites of a dark room are—absence of all white lights, a supply of water, and sewer connection for waste water.

The dry plates used at the present time are so extremely sensitive that a single ray of white light would spoil them for the purpose of taking pictures.

Orange-colored or ruby light does not affect the plates to a great extent, and such light may be admitted in small quantity. The dark room may be made sufficiently light-tight by pasting orange-colored paper over all cracks and openings in the walls, but for permanent use it would be better to secure tight walls by matched or double boarding, plastering, or by some other method.

A list of the chemicals and utensils used in photography may be obtained from the catalogues of any dealer. The rudiments of photography may be studied from the same source, and, combined with practice, sufficient knowledge of the art to enable the production of serviceable pictures may soon be acquired.

To photograph a machine, the first act is to place the machine in a good light. Photographs *can* be made in almost any light which will enable the machine to be seen, but the better the light the quicker and better the picture will be made.

A machine, placed out-of-doors on the snow-covered ground, in bright weather, but protected from the direct rays of the sun, is in position for a first-class picture with but one or two seconds' exposure, but, if the machine be in a dark basement, where the light is indifferent, minutes or hours of exposure may be necessary. In some instances a much longer exposure is required.

A printing press in a room lighted by four 16-candle-power incandescent electric lamps, required four hours' exposure to secure a good negative. The big organ which once stood in Music Hall, Boston, and the interior of Trinity Church, in New York, required, when photographed, an exposure of seven days.

The correct time of exposure can only be determined by experience, but an approximately correct time will be quickly learned.

Let us set up our camera before a machine, uncap the lens, and move back the ground glass screen until the image of the machine appears distinct—or sharp, as the photographers call it. Now, note the size of the image. If it is too large, increase the distance between camera and machine. If the image is too small, decrease the distance until the requisite size is obtained.

Next, recap the lens, remove the glass screen, and put in its place the plate-holder, in which a plate was placed while we were in the dark room. Now draw the slide out of the plate-holder, and uncap the lens for 30, 40 or 50 seconds, or for the time we judge the existing light to require. When the given time has elapsed, recap the lens, replace the slide in plate-holder, go to the dark room and develop the negative according to instructions accompanying the apparatus.

The "know how" is just as essential in photography as it is in running an engine or building a machine tool, and it may be acquired in precisely the same manner, viz., by study, experience and the use of brains.

There are hundreds of little points which go to make up the art of photography, and, when more or less of these points are observed, the result is more or less satisfactory.

When once a good negative is secured, a water-color paint may be applied, which blots out all background, floor and other surroundings, leaving the machine standing in bold relief upon a white background. From the negative thus prepared, prints may be made *ad libitum*, precisely as blue prints are made, and blue prints can be made also.

In addition, photo-electrotypes can be made directly from the negatives, or, better yet, prints can be made directly upon prepared blocks, which are then made into wood engravings.

From a pecuniary view, there would not be much of a saving caused by doing our own photographing, particularly until we "get the trade learned."

Other reasons count largely in favor of machine-shop photography, especially Chordal's reasoning that the only way to get a negative away from a photographer was "with a club."

In this, as in many other things, if we do the work ourselves, we get it done when, where and as we wish.

The American Society of Mechanical Engineers will hold its spring meeting in Chicago, beginning May 25th. Headquarters will be at the Grand Pacific Hotel. The following papers will be read:

Wilfred Lewis, "Experiments on Transmission of Power by Belting."

Wm. O. Webber, "Rel. Efficiency of Centrifugal and Reciprocating Pumps."

Horace See, "Production of True Crank Shank Shafts and Bearings."

Geo. H. Babcock, "Substitutes for Steam."

Chas. W. Barnaby, "New Steam Engine Indicator."

F. G. Coggin, "Novel Chimney Staging."

Thos. S. Crane, "Water Purification for Manufacturing and Domestic Consumption."

H. R. Towne, "The Engineer as an Economist."

H. Metcalfe, "Shop Orders and Accounts."

C. M. Woodward, "Manual Training Schools."

O. Smith, "Inventory Valuation of Mach. Plant."

Fred. W. Taylor, "Value of Water-gas and Gas from Siemens Producers for Melting in Open Hearth Furnaces."

Wm. P. Trowbridge, "Ventilation by Heated Chimneys and Fans."

Thos. D. West, "Irregularities in Contraction of Duplicate Castings."

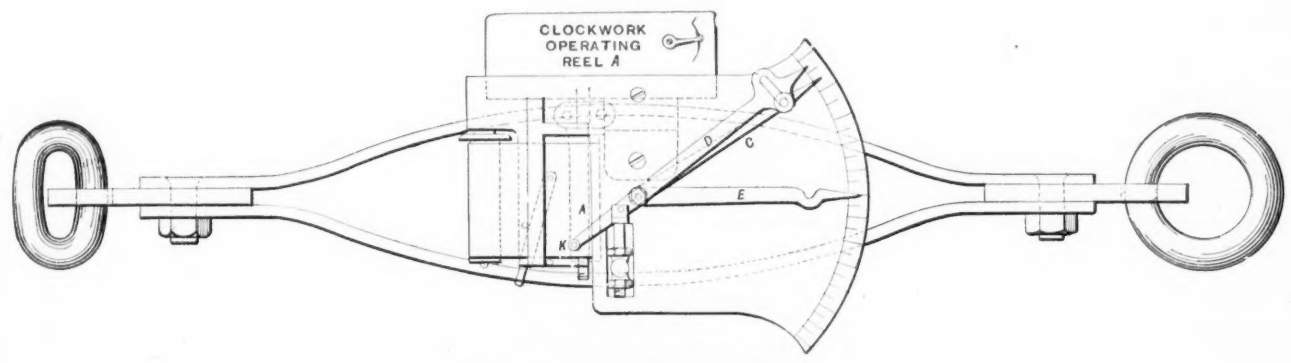
C. M. Giddings, "Dynamometer for Measuring Power Required to Move Slide Valves."

John H. Cooper, "Grain Handling in California."

Traction Recording Dynamometer.

The engraving illustrates a new recording dynamometer, designed especially for traction engines. The design has been made to overcome some of the difficulties in the use of the ordinarily constructed dynamometer, when used to test the pull of traction engines, such as excessive fluctuations, due to resistances met with on the road.

It consists of a pair of elliptical steel springs joined at the ends, having proper attachments at either end for load and engine. To one of these springs is attached the dial plate having the graduations on it; to the opposite spring, by means of an adjustable connection, the pointer *C*, having an extension past the pivoted point of an arm which holds the pencil *K*. A pin in the opposite end of this pointer extends through both above and below. The top end works in the slot of the averaging hand *D*, which is made dark color to distinguish it from the other when in motion. The lower end of this pin strikes the pointer *E* and carries it up to the point of greatest tension, where it remains. To the first of these springs is also attached mechanism driven by a spring which rotates spool *A*; this can be stopped and started by means of a lever working in a slot.



Traction Recording Dynamometer.

The paper is properly ruled to correspond to the scale of the instrument, and is wound on a wooden roller. It then passes under a finger, over a plate, and is wound on the spool *A*. Both spools are easily taken off and a new paper put on by depressing a thumb piece, which serves to hold the paper in position. The pointer *C* serves to record the pull exerted on the moving paper, by means of the pencil *K*, indicating the same on the dial. The dynamometer is tested by an actual load of known weights, 500 lbs. or less at a time, and the dial graduated throughout the entire range of action.

With this instrument both the maximum and average pull exerted by a traction engine in moving a load over a piece of road, can be accurately determined, and what is more important, the rate of passage over the given distance. Then to test the maximum capacity of an engine, it is only necessary to increase the load uniformly with each successive passage over the route assigned, until the limit is reached at which the engine can no longer maintain a paying rate of movement. This, under ordinary conditions, should not be less than two and one-half miles per hour for heavy hauling, while four to six miles per hour is feasible with lighter loads.

In making these tests with the dynamometer the best resistance has been found to be a very heavy stone boat loaded with pig iron, having a strong hinge bail attached to each end for the purpose of pulling out of places where there is not room to turn around. This makes a compact load, which can be easily varied to suit both the engine and road, and is capable of receiving considerable abuse without injury; it is easily and quickly made, at a small cost. Experience has shown that much can be learned as to the capabilities of a traction engine with this simple device, as the value of almost every change or improvement can be clearly demonstrated and recorded for future reference. This holds true whether the change be in the design of the boiler, either as to its steaming capacity, its tendency to work water, or any change in the size or location of the road wheels with reference to center of gravity, rate, or design of gearing, or any change in valve movement or engine itself, and especially any change in rigid point of attachment between load and engine.

What the instrument will show and record is: 1st, The actual pull exerted by a team of horses, a traction engine, a tug boat, a small locomotive, or street motor; 2d, The power required to move a load by any of these means over any kind of a road, under any varying conditions; 3d, The power required to pull one or more plows at varying depths in different kinds of soil by means of a steam plowing engine; 4th, The relative pulling capacity of engines of different weights, other things being equal, and the benefits of different ratios of traction gearing with reference to revolution of engine; 5th, It will demonstrate the benefits derived from putting the main driving axle of a traction engine either in front or back of the fire-box, also the advantage of large road wheels over small ones; 6th, It furnishes a conclusive proof of the advantage or disadvantage of driving from two or four wheels of a traction engine; 7th, The relative efficiency of two traction engines for hauling purposes can be shown by multiplying the distance passed over in a given time, into the pounds pull shown; this gives foot pounds of work done, and can be reduced to horse-power by dividing by 33,000.

This instrument will also show and record with accuracy the relative drafts of horse-powers, reapers, mowers, grain drills, plows, wagons and a great variety of farm machinery; will enable each builder of traction engines to know exactly what he can guarantee his engine to do when properly handled, etc., and so establish its rating with others.

It is the invention of C. M. Giddings. Manufactured by Schaeffer & Budenberg, 40 John street, New York.

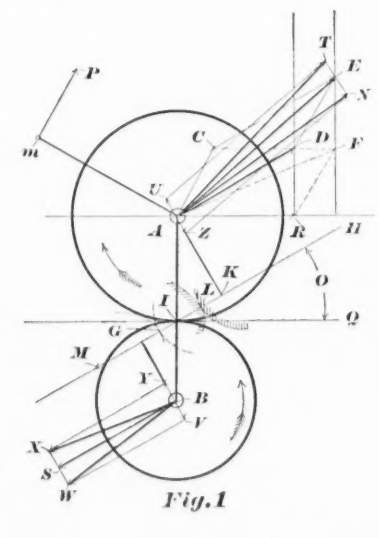


Fig. 1

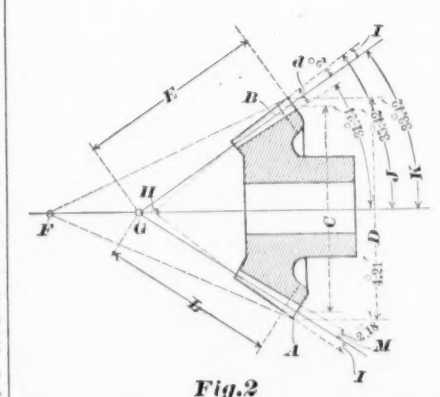


Fig. 2

English papers explain the decadence of electric lighting in England and its increase in this country by the fact that the charges for gas are from two to three times as much here as there. So far it is said by the gas companies in this country that the only effect, so far as they are concerned, of the use of electric lights is to increase their business.

Efficiency of Gear Teeth—Sizing Bevel Gear Blanks.

By C. A. Smith.

For previous articles relating to this subject see the following issues of the American Machinist: 1885, October 31, December 26; 1886, January 16, February 6.

In issue of January 16 I called attention to some errors which I thought ought to be corrected for the good of the public, especially those referred to in issue of December 26. In issue of February 6, Geo. B. Grant denies nearly all that I said, without giving any proof to support his assertions. Some of his statements are rather contradictory. The sixth paragraph is an example.

Mr. Grant certainly has a wrong impression if he thinks I make an idol of the epicycloid. The involute has by far more good qualities than the epicycloid, and I am not defending the latter curve, but the truth; that is, the scientific laws. I would be glad if we could prove the involute superior from the point of efficiency; but we cannot have things as we would like them in this case. We must take them as the laws of Nature have made them.

He says I was "too hasty" in criticising his article. If this is so, there are some things which perhaps Mr. Grant will kindly explain.

1. In applying the common sense test tool to the involute (December 26 issue) we find that the work lost by friction depends upon the obliquity or the angle "*M*," because when "M" = 0, then the normal pressure is infinite, and the work required to overcome the friction is infinite. Equation (2) says it is constant and independent of the angle "*M*."

2. Mr. Grant says "*I*" is constant, however the distance between centers may be varied. The equation says "*I*" varies with the line of centers, since the latter depends upon "*h*" and "*k*," which become variable in that case. Common sense also says it varies, since, all other things remaining the same, the line of centers cannot vary without a corresponding variation in the angle "*M*." There must be something wrong with the equation or with my "understanding;" which is it?

3. After equation (6), for epicycloidal teeth, we read: "When $s = \infty$, E = I." I always thought that

$$\text{Log. cos.}\frac{180^\circ}{\infty} = \text{log. cos. } 0^\circ = \text{log. } 1 = 0,$$

which would make E = O. But for "*E*" to be zero under these circumstances is manifestly absurd.

4. If the work lost by friction is independent of the obliquity in one case—equation (2)—how is it that it does depend upon that angle in another case—equation (6)?

5. I do not understand the advantage of determining the work lost for only *a part* of the path of contact instead of the whole, unless it is that, by so doing, we can favor either tooth we choose and prove it the best. Why would it not be the right thing to take the path of contact as we find it in practice and make a practical comparison? This depends upon the addendum circles and the describing circle. The former is usually 2 ÷ diametral pitch greater than the pitch circle, and the latter is, for the epicycloid, the pitch circle of a wheel of 7½ teeth. Perhaps Mr. Grant puts too much stress upon his "half-a-tooth-distance" which can never be considered a practical case, if that is taken as the limit of contact. But I will not take up any more time on these points, but pass on to consider

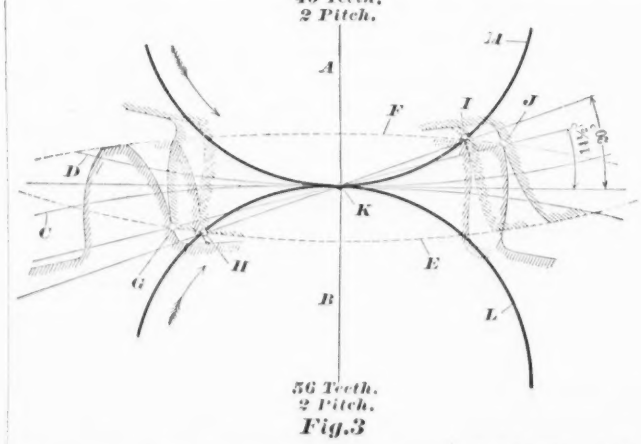


Fig. 3

Journal Friction.

Referring to Fig. 1, let *A* and *B* represent two shafts; the shaft *B* to be driven by the shaft *A* by means of two gear wheels, whose pitch point is at *I*. Let us assume any point, *m*, at which a constant force *m P* is applied to drive the shaft *A*. The point *m* may be on the periphery of a pulley, or pulleys, with belt moving in the direction of *P*. The line *I H*, passing through the point of contact *L*, and the pitch point *I*, gives the direction of the normal force of the teeth and the angle *H I Q* = *O* is the obliquity. Let *L M* be the normal pressure, then

$$\text{L M} = \frac{m\,\text{P} \times m\,\text{A}}{\text{A K}}$$

A K being perpendicular to *I H*.

Now, the pressure upon the shaft bearing at *A*, due to the applied force *m P*, is *A C*, equal to *m P* and in the same direction. For convenience of comparison, *m P* may be assumed to be constant in intensity, as well as direction; then *A C* will also be constant.

The pressure upon the journal bearing *A*, due to the reaction of the normal pressure *L M*, is *A D*, equal and parallel to *L M*, but in the opposite direction. *A E*, the resultant of *A C* and *A D*, is, therefore, the total pressure upon the journal bearing *A*.

Again, take the obliquity *O* equal to zero; then the normal pressure will be in *I Q*, and we get *A F* as the resultant journal pressure.

The component *A R* of the *normal pressure*, at right angles to the line of centers *A B*, is constant, and the one in the line of centers is variable, and increases with the obliquity. Likewise the components of the resultants *A E*, *A F*, etc.

It seems, then, that the journal pressure depends upon the obliquity. But we all know that the obliquity depends upon the form of tooth; therefore, the journal pressure is influenced by the form of tooth.

The resultants *A E*, *A F*, etc., would represent the true condition of the journal pressure, if there was no friction between the tooth surfaces; but this introduces another force, *A U*, on the journal bearing, and it is equal to the normal force *M L* multiplied by the coefficient of friction, and acts at right angles to *I H* or *M L*. Compounding this with the resultant *A E*, we get the final resultant *A T*. *A U* varies with the obliquity, both in direction and intensity. While the point of contact *L* is within the angle of approach, *A U* has the effect to increase the journal friction, and to decrease

it while contact is within the angle of recess (as at G), because then it acts in the opposite direction, $A\ Z$, giving the resultant $A\ N$.

On the journal bearing B, this force, $B\ V$, is always equal and opposite to $A\ U$. $B\ W$ and $B\ X$, then, represent the resultants, on the journal bearing B, of the normal pressure, and sliding pressure, while the point of contact moves in the angles of approach and recess, respectively. By compounding these with the useful resistance, we would get the total pressure at the journal B of the driven wheel.

Now, is the efficiency practically independent of the journal pressure?

Let V=Angular velocity of large gear A.
" v = " " " small " B.
" R=Radii of journals (the two supposed to be equal).
" N=Normal pressure $L\ M$.
" f =Coefficient of friction.
" b =$I\ L$, distance of point of contact from pitch point.
" w =Rate at which work is absorbed by friction at any instant.
" W=Total work lost in the time t.

As we have seen above, there are three points at which the work lost is influenced by the obliquity O—viz., the journals A and B, and the point of contact L. Suppose, now, we consider the loss of power due to the normal pressure only, then—

The rate of the loss of power at.....$A = N f R V$.
The rate of the loss of power at.....$B = N f R v$.
The rate of the loss of power at.....$L = N f (V + v) b$.

Therefore, the total rate at which power is lost is:

$$w = N f R V + N f R v + N f (V + v) b;\ \text{or,}$$
$$w = N f (V + v) R + N f (V + v) b. \qquad (1)$$

The total work lost in the time t, supposing w to be constant, is:

$$W = wt = N f t (V + v) R + N f t (V + v) b. \qquad (2)$$

The two terms of the second member of this equation are exactly alike, with the exception of R and b. R is constant and b is variable. Suppose b to be constant (as assumed above to make w constant), and equal to its *maximum* value, which is at the beginning or ending of contact; then in actual practice the first term (journal friction) is almost *always* greater than the second term (tooth surface friction), since R is most always greater than b. But, as the *mean* value of b for a given time t is only one-half of its *maximum* value, the journal friction in actual practice must necessarily be considerably in excess of the sliding friction of the teeth. Hence, neglecting the first term as "small" and inconsiderable, as Mr. Grant does, becomes a fruitful source of error.

Now, the above comparison is made for that part of the friction only, which is directly a function of the obliquity. If we were to determine the actual efficiency, then we would have to take into account the *total* journal pressure, as explained above.

To make a comparison between involute and epicycloidal teeth, equation (2) may be written:

$$W = (\text{function O})\ (\text{function } b)\ (V + v)(R + b) f. \qquad (3)$$

In actual practice, the mean obliquity O is always less with the epicycloid than the involute, and therefore "(function O)" is less on the former curve; also, the maximum value of b is generally smaller for the former curve than the latter.

This is clearly shown in the example of Fig. 3, which represents two gears of two pitch—40 and 56 teeth. C and D are the pitch circles; E, F the addendum circles. If the gears have involute teeth, then the path of contact will be on the straight line $G\ K\ J$, having the usual obliquity of $14\frac{1}{2}^{\circ}$, as shown. If the wheels rotate, as shown by the arrows, the contact will begin at G, the intersection of the addendum circle E, and the path of contact $G\ J$. The end of contact will be at J, as shown. The approaching action $G\ K$ is $1\frac{9}{16}''$, and the recess $K\ J$ is $1\frac{5}{8}''$.

Now, if the same wheels have epicycloidal teeth, the describing circles L, M, will be $3\frac{3}{4}''$ diameter for two pitch, and the path of contact will be the ogee line $H\ K\ I$. The contact will begin and end at H and I respectively, as shown by the dotted tooth curves. In this case the recess $K\ I$ is $1\frac{5}{16}''$, and the approach $K\ H$ $1\frac{9}{32}''$. The recess being the greater, we find the maximum obliquity on this side, and it is 20°. Hence, we have the *mean* values:

For involute teeth, $K\ J = b = 1\frac{5}{32}''$ and $O = 14\frac{1}{2}^{\circ}$. For epicycloidal teeth, $K\ I = b = 1\frac{5}{16}''$ and $O = 10^{\circ}$, O and b being both less for the latter than the former curve. But any variation of W in equation (3) depends only upon O and b, therefore W, the work lost, must be less for epicycloidal than it is for involute teeth.

SIZING BEVEL GEAR BLANKS.

Mr. Grant (Feb. 6 issue) does not seem to understand my remarks on the above subject, so I will explain more fully.

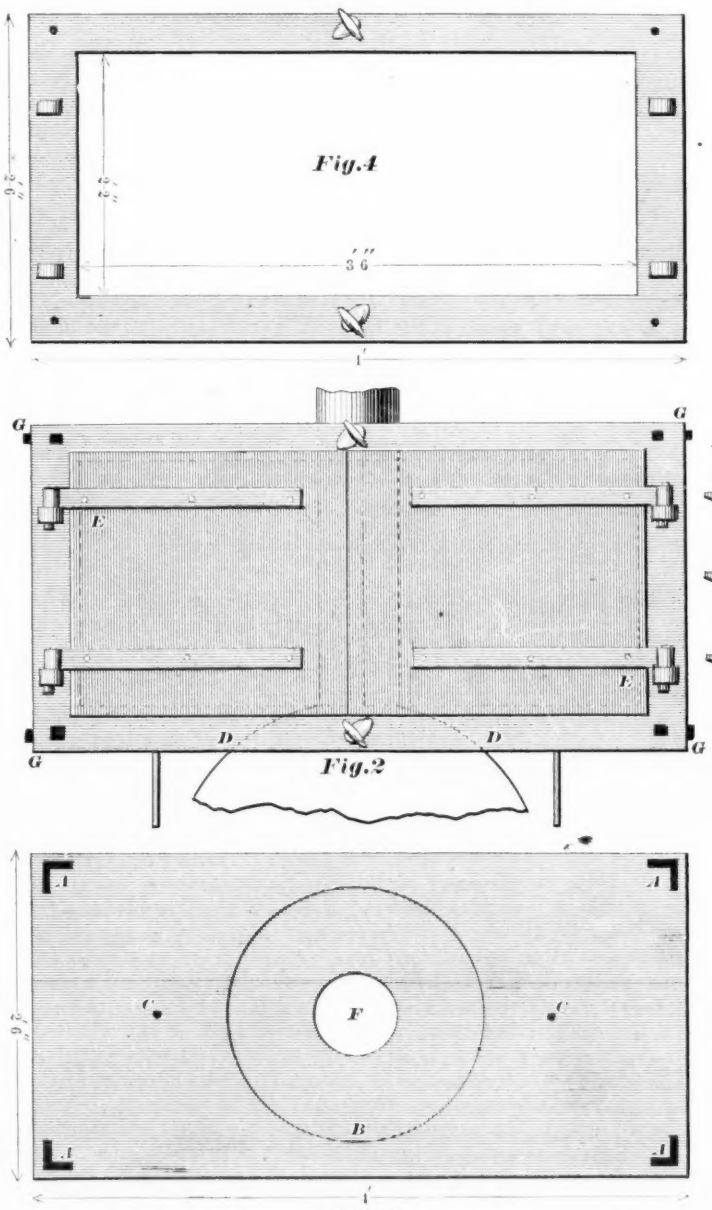


Fig.1

CORE OVEN.

First, it seems necessary to explain that by "sizing bevel gears" we mean the operation of turning the blank to its proper form and size, and this is usually done in the machine shop and not in the drawing room. Designing a gear is entirely a different thing, and precedes the former process. This we all know. "If he had looked twice he would have seen that" I was speaking of *sizing gears*, and *not* of "original designing."

In Fig. 2 we have a bevel gear—dimensions as follows:

Pitch angle = 33°, 42'.
Addendum angle = 2°.
Face angle = 35°, 42'.
Cutting angle = 31°, 24',
32 teeth.
8 pitch.
Pitch diameter = 4''.
Blank diameter = 4.21''.
Face = $1\frac{3}{8}''$.

Suppose the gear is finished—32 teeth cut and all in good order. Now cut off some at the back, down to the dotted lines A and B, reducing the face. Does this "change the number of teeth?" We see it has the same teeth it had before it was cut off, and 32 is the number. But the diameter C is smaller than it was before (D).

Now this is, in effect, the only permanent mistake that can be made by getting the diameter D too small in sizing the blank. That is, the apex distance E is reduced. The lathe-man has no excuse for getting the face angle wrong when he has the dimension, 35° 42'; before him, supposing that he has the tools he needs for doing the job. If he gets the angle too small, so as to bring the apex to F, all he has to do is to turn a little more off the small end to increase the angle until it is right. If he gets it too large, so as to bring the apex to H, he can turn some off the large end, and *make it right*. But in facing off the back there may not be stock enough to make the required diameter D (or the apex distance E), or the machinist may have made a mistake otherwise, and got it too small. Whichever it may be, there is no excuse for getting the *angles* wrong. The pitch angle K depends upon the velocity ratio only, which is constant. The addendum angle I depends upon the number of teeth and the pitch angle only—

$$\tan.\ I = \frac{2 \sin.\ K}{N}$$

N being the number of teeth; or

$$N = \frac{2 \sin.\ K}{\tan.\ I.}$$

From this we see that since K and I are constant for any given gear, N is always the same whether the diameter D is two inches or two miles.

If the diameter of one gear has been turned too small, reducing the apex distance to L, then, as Mr. Grant says, its mate must be reduced correspondingly, *i. e.*, to the same apex distance L—always measured on the pitch cone. As was stated before, in practice we usually measure this distance indirectly by the blank diameter D.

Of course, there is nothing to prevent redesigning the gear and increasing the number of teeth to decrease the addendum angle I, thus making entirely a different gear than was originally intended, but where the necessity of this comes in, I cannot see.

Core Oven.

BY ROBERT E. MASTERS.

There are a number of small foundries, termed "country shops," that make a class of work wherein they use a number of small and ordinary-sized cores, and yet have no arrangements whatever for drying them. If they run by steam-power, they will put them on top of the boiler or in the smoke-box to dry, and waste more time in a year watching the cores to keep them from burning than would pay for a convenient core oven. Or if the foundry is run by water or horse-power, they will have plates full of cores ready when they fire up the ladles, and, putting a couple of bars across the ladle, set the plates thereon to dry; in this case the heat is all on the under side of the plates, and results in the cores getting burned on the sides next to the plate before they are dried on the upper side, unless they are turned over, which act is accompanied with a great deal of danger of burned fingers and broken cores.

Some of the boys may smile at the idea of a foundry running by horse-power. I have in mind a foundry that used to turn out some very good work of the smaller class, running, on an average, three 1,500 lb. "heats" per week. When ready to cast, the horses were brought in and hitched to the horse-power, and, when everything was in readiness for a start, the driver would give the word "*Git up*," and that was the last you could hear of the human voice in that shop until the heat was taken off and the horses stopped. The fan made so much noise that it could be heard for a distance of a mile or more. In this foundry they had no oven at all for drying cores, although they used quite a number. The foundry was situated on a lot adjoining the residence of the man that run it. When he needed cores, he would fill some plates with them in the foundry, then carry them to the house, and put them in the oven of the kitchen stove. There seemed to be a very fair understanding between the man and his wife, so that his "baking cores" did not interfere with her baking bread.

The accompanying cuts will show a cheap, convenient oven for "country foundries," and can be used to advantage in large shops. All the plates for this oven can be cast in open sand with only a few lugs and strips for patterns, or, if a smoother outside appearance is desired, cheap plain patterns can be made and the castings made in flasks.

Fig. 1 is a cast-iron plate $\frac{3}{8}''$ thick, 2' 6'' x 4'. This plate has an angle lug A, A at each corner; there are two pieces of this cast—one with a large hole in the center, shown by the line at B, and two $\frac{3}{8}''$ holes C, C. This is placed over the top of an "egg-shaped" stove, as seen by the dotted line $D\ D$, Fig. 2. Half-inch rods are put through the holes C, C, and through the ends of a wrought-iron bar placed across underneath the stove and screwed fast. This gives a firm foundation for the oven, and keeps it from tipping.

Two plates 2' 6'' square, with ribs on them, seen in section, Fig. 3, are cast for the sides of the oven; these ribs are rests for cast or wrought-iron bars to set the core plates on. A plain plate is cast for the back, and a framé, Fig. 4, is cast for the front, with lugs on it, for the sheet-iron doors E, E, Fig. 2, to swing on. The second plate, Fig. 1, is cast with angle lugs at each corner, and a hole F in the center large enough to fit over the pipe for the top of the oven. The sides, front and back plates are bolted to the top and bottom plates through the lugs A, A, as shown at G, G, Fig. 2.

This style of oven does not need to be confined to stoves having a pipe directly on top. It can be used on a stove with a flat top, having a hole cast in the bottom plate to suit the top of the stove, and the stove pipe can be outside of the oven altogether for that matter.

It is illustrated in this manner simply because we had a stove of this style in the core-room for heating purposes, and built an oven on it to dry cores that we needed in a hurry through the day, thereby making the same fuel answer a double purpose—viz., heating the core-room and drying a large number of cores. I have dried cores $2\frac{1}{2}''$ diameter in this oven in thirty minutes. By removing the bars from the upper shelves, a good-sized core can be dried for "country shops" without being burned or covered with soot.

LETTERS FROM PRACTICAL MEN.

Lining Engine Lathes.

Editor American Machinist:

In your issue of April 10th, Chas. S. Beach in his remarks does not seem to understand my article and sketch of March 27th, or he would see that it is applicable to any lathe in use, no matter how old or whose make. I will try and make it more plain.

It is simply to drill two holes and cut a slot through the head stock $\frac{3}{16}''$ to $\frac{1}{2}''$ or more wide, and double the width up and down (according to size of lathe) just below the bottom of box and through the seat; then cutting a taper channel in bottom of box to correspond, and to match taper of key.

My experience of 25 years running and building light and heavy lathes is this: If properly oiled and cared for, the outer box needs but little adjustment for years, except to keep it from being box-bound, unless the front bearing is short and small—now being replaced by large and long ones in modern make.

His reference to the Brown & Sharpe Manufacturing Company's treatise on universal milling machines, as I understand it, means the solid box taper bearing, which makes a very poor rig for lathes, but well adapted to milling machinery.

I had under my charge in Canada two shafting lathes built years ago by a Toronto firm, in which the taper bearing solid box was used, and as they were worn down we had to shim up between head-stock and shears to raise the center; this caused them to chatter, giving a great deal of trouble.

I do not believe anything can be substituted for the half box which is as good in all respects.

I must take exceptions to his way of testing, as being unhandy. All chucks should be out of the way and the box free to get at. It is simply impossible to get a spindle right the first time testing, no matter how accurate one may be. It takes just a little more or a little less packing. Each time trying, the lathe must be put together and taken apart for the packing, and the test centers put in and tried again to see if it is all right before it can be passed.

Now my way of doing the testing is to take two sticks, different lengths, a little larger square than the hole in spindle for the center.

Fit one end of each in the hole, having the stick run true. Cut the other end smooth and chalk it.

Put in the short one first and the belt on the fast speed, bring up the foot stock (having the dead center and spindle about 3" out) to nearly touch the end of the stick. Fasten all snug as for use in turning, then with a sharp pencil, with the dead center for a rest, make as small a mark as possible.

This will show how the live spindle will gun or lead to the dead center. Stop the lathe, bring one square on top, mark the position of center both top and side towards you as near as may be.

Loosen the tail stock, take out the stick and put in the other one, and proceed as before.

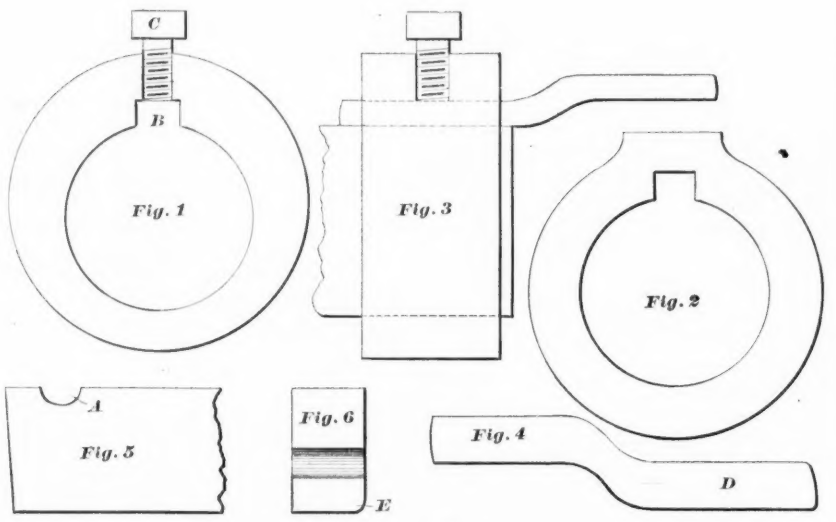
The difference between them will show which way the spindle must go, either up or down or sidewise. Should the mark on the long stick show below the center the front box must go up. Should both show below the center both must go up. A little practice and study will show how to do it by anyone after the above test. The test pieces may be made of round iron or steel and kept with the lathe for test centers.

If belts are used with the hair or smooth side to pulley, and a little inclination from perpendicular (or the counter shaft back or front of center over lathes) they need not be so tight, and will drive more and last longer, giving less wear to outer boxes.

He says that it has never been his fortune to find a lathe that would stand the test without overhauling.

The one mentioned being out $\frac{22}{100}$ in 3' 6" when new, does not speak very well for the maker. One used for months would certainly show out. I have tested a great many makes and have found but one that showed the slightest difference, and when that was examined a small piece of dirt had got under one corner of head-stock, and when put together again all came right. I do not see how they can come any other way than true from the manner of planing and boring by the builders, as all first-class makers have made special tools for the purpose.

Wm. H. Butler.



Toolmakers' Kinks.

Steam Heating vs. Furnace Heating.

Editor American Machinist:

In your issue of March 27, 1886, there is an article entitled "Heating Dwellings by Steam"; also in your issue of April 10, there is an article entitled "Steam Heating *vs.* Furnace Heating." The writer of the latter article says that he cannot think the writer of the article of March 27 has given much thought to the subject. Now, I cannot think that the writer of the article of April 10 has given much thought to the subject of heating dwellings by steam. He says the advantages a furnace has over steam are, "First, and most important, a supply of fresh, warm (not hot) air, and a complete system of ventilation not possible with steam." I want to correct the writer. In the first place, I would like to tell him that there are more than 600 houses heated by steam in Philadelphia, and better ventilation cannot be had. It is not all done by the pipes in the room (called direct radiation), but by the heating surface in the cellar (called indirect radiation).

Now, as to this indirect radiation, we take the air from the outside of the house direct to the bench or benches of radiators, through an air-tight wooden box or galvanized iron box. These radiators are boxed around tightly, with a space at the bottom for the cold air, and a space at the top for the hot air, with a roof perfectly level. The cold air comes in the box at the bottom, passes through the radiators to the top, thence up the flue to the room that is to be heated. These radiators are connected together; the steam goes in at one end and passes out at the other. The condensed steam is taken back to the boiler through the return-pipe, consuming about three gallons of water a week. By this system, the cold air does not have to pass through the dirt and dust that collect in the chamber of all hot-air furnaces, but passes directly through the boxes to the radiators, and thence up the flues. As to the running of these steam boilers, anybody can run them. They regulate the draft and the water automatically, whereas in most of the hot-air furnaces, if you do not watch your vapor pan, and keep it full of water, you will have the driest kind of hot air. Furthermore, I would like the writer of the article of April 10 to name me one kind of hot-air furnaces that will stay gas-tight for five years. I have seen over a dozen of these hot-air furnaces taken out on this one account.

C. P. B.

Philadelphia.

Toolmakers' Kinks.

Editor American Machinist:

One day I had a tap to mill, the shank of which was larger than any of the carriers the milling machine afforded. Being in a hurry, I devised the following, which is easily made.

I took a piece of round cast-iron, $\frac{3}{4}''$ thick, and large enough for the work required. I chucked it "out of true," bored large enough for shank, chipped a slot *B*, and tapped for set screw *C*; I bent up a "tail" *D* of $\frac{1}{4}''$ round wire, filing a groove where it bore on the shank of tap, and the carrier was done. Of course, it is not heavy enough for lathe work, but for milling it does very well. A better job would be to have a forging like Fig. 2, and by increasing its strength, it might be used for light lathe work. Fig. 3 shows how it is applied to work.

Would like to hear from some one who works on flat cutters or reamers, and hear what shape tool is best for turning them. I use one like Fig. 5, which is a side view; and Fig. 6, is a top view. I give very little rake, and grind the cutting corner like *E*, a little being enough to lengthen the life of the tool very much. The groove *A* makes it very easy to sharpen by merely grinding on the face.

I had a screw to make for a two-jawed universal chuck, to take place of a broken one. I succeeded in getting it quite true, but had to work on the "cut and try" plan. I suppose there is a method, and would like to know it. I would also like to hear bearings discussed: whether surface means friction in all cases. The advocates of ball-bearings say "less surface, less friction;" on the other hand, makers of flat-bed lathes claim there is less wear, consequently less friction.

Fred. H. Colvin.

Chimneys for Steam Boilers.

Editor American Machinist:

In Mr. Lowe's very instructive article on chimneys in the American Machinist of March 27, I note one omission, which is nearly universal in treating this subject.

Mr. Lowe allows nine square inches sectional area in a chimney of 50 feet height, and $4\frac{1}{2}$ square inches in one of 200 feet height for each horse-power, and throughout his paper he tacitly assumes, as is commonly done, that two chimneys of these two heights, built in accordance with these figures, will be identical in power and properties. This is true in one sense, but not in another. The purpose of a chimney is to contain a column of heated gas, by reason of which there is established a difference of pressure between its inside and its outside at its base. This difference of pressure is "draft," and by reason of it the air is forced (or, as commonly expressed, "drawn") through the fire. Now, the higher the chimney the greater this difference of pressure, and the greater the strength or intensity of draft. A high small chimney will pass the same volume of gas as a low large one, because its intensity of draft is greater—because it draws the air harder; hence it moves the gases with a greater velocity, and can discharge the same volume through a smaller flue. We see, then, that in velocity of gas passed, the chimneys are equal, but in strength of draft, as measured by a draft gauge, they are very different.

Now, different fuels require different intensities of draft; Cannel coal, for instance, can be very easily burned, while slack commonly requires a blower, but for equal quantities of fuel the volume of air required is substantially the same for both. The low intensity of draft required by Cannel coal can be obtained by a low chimney, while the high intensity required by slack can only be obtained by a high one or by a blower; hence the correct method of designing a chimney would be to determine the height with reference to the *kind* of fuel to be used, and then determine the area from the *amount* to be burned. The data available for this purpose are scanty and insufficient, and doubtless this method is usually considered a theoretical and unnecessary refinement, but doubtless also many failures are to be attributed to the neglect.

Fred. A. Halsey.

Heating by Steam or Furnace.

Editor American Machinist:

In an article published in your issue of April 10th, "Steam Heating *vs.* Furnace Heating," some of the conclusions of the writer are so erroneous they should not pass unanswered.

First—It is a mistake to conclude that any building can not be better warmed and better ventilated by a proper steam heating apparatus than by any hot air furnace yet invented.

With steam heaters the various rooms can be effectively warmed and thoroughly ventilated at all times and in any weather, no matter what may be the direction of the wind; while with hot air furnaces it is a notorious fact that it is difficult to properly warm the exposed rooms on windward side of the building in cold, windy weather.

In ventilating by a hot air furnace the amount of fresh air passed through the rooms must necessarily be many times greater in cold, windy weather than in mild, still weather, so that at such times when least ventilation is needed you get the most, and when most ventilation is needed you get the least; while with a properly constructed steam-heating and ventilating apparatus the amount of fresh air admitted is under perfect control, and can at all times be adjusted to the requirements of the weather: hence the great economy of fuel in a steam heater as compared with a hot air furnace.

Second—It is a mistake to conclude that the air from a low pressure steam heater is hot or dry as compared with the air from a hot air furnace.

The air passing over the hot surface of the red-hot iron fire pot of a furnace has the moisture and life burnt out of it, while the air passing over a low pressure steam radiator carrying from one to five pounds steam is raised to a temperature but little above boiling water, while red-hot iron is at a temperature of from 1,000 to 2,000 degrees. Hence, the steam-warmed air retains its moisture, while the furnace air does not and cannot.

Third—It is a mistake to conclude that gas and smoke and dust and ashes do not pass from a furnace into the rooms to be warmed, no matter how large nor how tight the construction of the box leading cold air to the furnace, as the gas and dust come from the furnace itself; the intense heat to which the plates of the fire-box are subjected soon warping these plates so as to open the joints, and thus permit the escape of gas, smoke and dust to the hot air flues leading directly into the rooms.

A new furnace when first put up, if carefully cemented in the joints, as is customary,

may remain tight for a short period, but usually one winter or, at most, two, puts the fire pot in condition to admit sufficient smoke, gas and dust into the rooms to render the air unwholesome and furnish ample dirt for the housekeeper.

It is not a mistake to caution purchasers to select a furnace that is so constructed that it is impossible for any gas to escape from the fire box, but unfortunately no such hot air furnace has yet been produced.

The first cost of a hot air furnace is considerably less than for a first class steam heater, but the cost of frequent repairs to the furnace from causes above noted soon makes the cost of a furnace as much or even more than for a steam heater, while the extra cost for fuel for a furnace very soon makes a steam heater far the cheapest as well as the best investment.

It is the experience of numerous parties who have used both hot-air furnaces and steam heaters that the latter is so far superior to the former in effectiveness, durability, economy of fuel and of labor of attention, ease of management and quality of heat and method of ventilation, that there is no just comparison between them.

W. E. HAXTUN.

Kewanee, Ill.

Steam Engine Proportions.

Editor American Machinist:

I notice in your columns of late some very good papers on the proper proportions of the running parts of high-speed engines. It strikes me that we never, or very seldom, see *all* the best proportions used in the construction of any one engine. There is generally some part which proves troublesome to the engineer. I believe it is because the makers have not the time nor the opportunity of watching how all the different parts act after the engines are sold and running.

Who is to tell the builder that the crank-pins of his engines are too small, or that the piston is too narrow to wear well at the speed the engine runs? Not the buyer, for he lays the blame of a hot crank-pin or a scored cylinder on the engineer, and after he (the engineer) is disposed of, the next man has the former engineer to put all blame on. I have an idea that if some of your readers who have troublesome engines, and who know enough about the thing to place the cause of the trouble, would write on the subject, it would be good for the engineer of the future, if not for us, as the builder would profit by our experience and perhaps remedy defects.

At present I am in charge of an engine 30″ bore × 42″ stroke, plain slide valve, running 83 revolutions per minute, steam pressure 85 lbs. I have had plenty of trouble with it, as we require all the power we can get out of it for a large saw mill. And right here I wish to remark that a saw mill will find all the weak points in an engine. The proportions of the engine at first sight seem very good, but I found out that extremes can meet even in an engine, for some parts are worthy of better company than they have. The crank-pin is 7½″ diameter and 5½″ long, and has never warmed up, although we run night and day, but the piston could not be kept from cutting, no matter how well fitted up and lubricated, because it was only 4″ wide (or narrow).

Some one will remark, "Oh, he set the rings out too tight." Well, I admit that; but what can you do when the piston covers the ports at each end of stroke, and the entering steam bangs it over, if there is the least slack to the springs. I am certain my cylinder would be smooth to-day if the piston had been 8″ long, and steam ports recessed into the covers. But this was only a trifling defect compared with the crank-shaft bearing. The crank-shaft was 12″ diameter; pillow block, 20″ long; bottom and top quarter-boxes babbitted; side boxes cast iron (lined with brass). Here is the funny part. The maker thought as long as brass was interposed, let it be never so thin, it would act as well as solid boxes. Well, it did run well at first, quite cool, showing the journal was all right for size, when all at once, in about five minutes, I had to shut down the mill for a day. Box had heated, and babbitt was anywhere and everywhere. The cause of heating was a bit of dirty tallow, which would not have hurt a babbitt box but that thin brass got a little warm and had to expand. It got longer than the cast-iron backing, but being riveted at each end it just bulged out against the shaft, and, as I always run my boxes close, there was no room. It was the quickest heat I ever saw. The babbitt was out at bottom of box, and the tallow not melted in the top. I replaced the side boxes with solid phosphor-bronze of same size, and have no trouble.

Mr. Hoffman recommends the side boxes divided in the center, so each wedge acts independently. He is right, for I find on inspecting mine, after a season's run, that they wear on the crank side, and when trying to adjust them the center wears the hardest, and I have to scrape them to fit. The divided box would be better, as each piece would set up squarely and adjust itself. If the builder of my engine should recognize his handwork, I trust he will reform his ways, and if he does I will have accomplished some good.

T. PRICE.

Blower or Chimney.

Editor American Machinist:

Your "scissors man," when he clips interesting items, like that on "Blower and Chimney" from the "*Mechanical World and Steam-Users' Journal*," should add a note of disapproval when such items contain a gross fallacy, otherwise the AMERICAN MACHINIST may be the means of conveying misinformation to its readers. The article in question is based on the fallacy that the draft produced by a chimney and the pressure produced by a blower are essentially different things, and differ in their effects. It says: "If the air which makes the fire burn be drawn through the fire under pressure, a greater and denser body of heat will operate upon the heating surfaces than possibly can under any kind of draft, either forced or natural."

The "draft" of a furnace is simply its capacity for getting air to the fire and for getting rid of its gases of combustion. It depends on the area and shape of the air and gas passages, and on the *difference of pressure* between the air entering the furnace and the gas escaping at the chimney. This difference of pressure is what is ordinarily called the draft. If the pressure of the atmosphere at the ash-pit door is, say, 15 lbs. per square inch, or, say, 30 inches of mercury barometric pressure, and the pressure of the waste gases in the chimney is exactly the same, there will be no draft—the chimney will not "draw." But if the chimney is high enough, and the gases in it warm enough, there may be a difference of pressure of, say, one inch of water (equal to about $\frac{1}{14}$th of an inch of the mercury barometer, or .036 lb.), and this will make a strong draft. The same result will be produced if the tall chimney is dispensed with, and the same difference of pressure produced by a blower. In the latter case, the pressure at the ash-pit will be 15.036 lbs. per square inch and at the chimney 15 lbs., and in the former case t e ash-pit pressure will be 15 lbs. and the pressure at the chimney 14.964 lbs., the difference of pressure being .036 lb. in either case.

There is no difference in effect upon the heating surfaces, whether the draft is produced by blower or chimney. The question which should be used is generally one of relative first cost, convenience or controllability under variable conditions, and its solution will vary according to circumstances.

WM. KENT.

[Our correspondent is an engineer of much experience in the matter referred to, and his opinions are entitled to consideration. His understanding, however, of the meaning of the writer quoted is different from ours. To us it appears plain that no comparison as between forced and natural draft is intended, but that the reference is to an actual, and considerable pressure around the heating surface of a boiler. Forced draft would be used for this purpose simply because it is the most available means. That is the air would be forced into the ash-pit, and the outlet beyond the heating surface "choked." This puts the heating surface and fire under pressure, the tendency being to more nearly equalize the value of the heating surfaces. The fact that there is considerable pressure beyond the fire is depended upon not to permit the escape of the hot gases by the readiest route, without reference to contact with heating surface.]

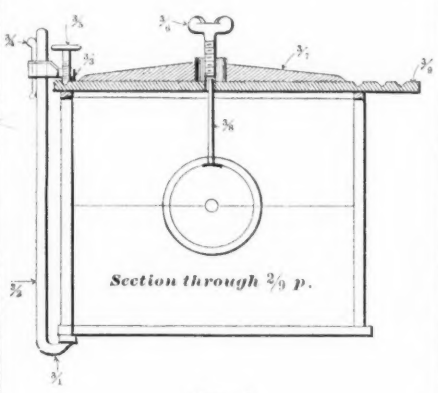


FIG. 3.

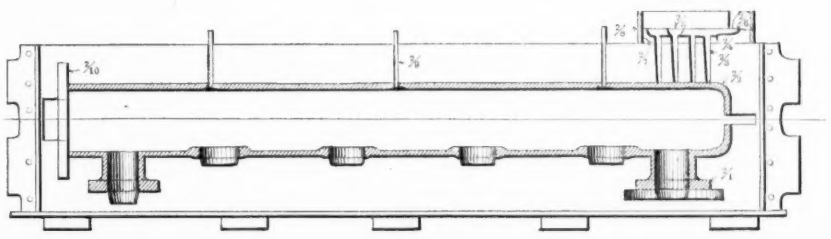


FIG. 2.

Lining Up Engine Lathes.

Editor American Machinist:

Noticing articles in recent issues of your paper on Lining Engine Lathes, I will give a little of my views on the subject. As Chas. S. Beach says, "it would be a step in the right direction" to abandon the old half-box and substitute a solid, hardened box of such shape that the wear can be taken up by longitudinal movement, such as used in the Brown & Sharpe milling machine and lathe. This, however, will only retain original accuracy in a measure, as lathes are known to wear more in one direction than another; therefore this box may be worn more on one side than the other, and they would in time get out of line, for there is no such material as will not wear at all. It will therefore be seen that the spindle would still have some chances to get out of line. My plan to remedy this trouble would be to bore out the head stock for these boxes, slightly tapering for the forward box, and instead of a tightly driven box with a flange, I would thread the ends of it on that part which projects beyond the surface of the stock, and also a threaded ring on each end of the box to be operated by a spanner wrench. Now, by slackening the inside ring, and drawing up the outside ring, the box will be relieved of the taper, and can then be turned very readily, and drawn back tightly into place again by the inside ring. The box may in this way be frequently turned one-half revolution, as it can be quickly done. Thus it will be seen that that part of the box which had the most wear is now put to the opposite point, and the wear will be changed. By this means we can preserve the original accuracy, at least to a greater degree than any other way I know of, and I think practically it would be very reliable.

To lubricate this box, I would turn a groove around the outside of the box, of good size, which would meet the oil-hole in casting and bore three or four holes from the groove to admit the oil to the bearing, so that in any position of the box the lubricating would be sure. The rear box can be turned in the same manner; but as that should be a straight bearing owing to the expansion by unequal temperature of the spindle, it is drawn into a tapering hole (being split), in order to adjust it. We cannot rely on the friction for holding it from turning; therefore a dowel pin is necessary, and two slots for it to enter, would prevent turning and allow the half turns of the box. By this means the changing of the boxes would be a very small matter, and true alignment of the spindle would be preserved. The additional cost to apply the box in this way would be very little, and I think that lathe builders would do well to adopt something of this kind.

A. B. LANDIS.

Waynesboro, Pa.

Gating, Clamping and Securing Chaplets.

BY MATTHEW WIARD.

In casting a cross pipe, 10 feet long and weighing about 600 lbs., my method is to cast from the top through four ½″ gates at each end, each gate tapered to ⅜″ at bottom.

No moulder would think it necessary to put a riser on the nozzle flange $\frac{9}{1}$ because it is on the bottom and he knows the metal above will make it solid, but would look for shrinkage on top of pipe $\frac{9}{8}$ or flange $\frac{9}{10}$. Then why not treat them in the same manner and make them the bottom. Also by giving sufficient height to the gates, he will get exactly the same results as with $\frac{9}{1}$, but always bear in mind that it is the *height* of metal that gives it density, not the *width*; therefore he must confine himself to small gates, for large ones or large basins will have exactly the opposite effect, and in addition will add greatly to the labor and to the cost. The gates $\frac{9}{3}$ are connected by channel $\frac{9}{4}$ made sufficiently large to feed them freely, but always to be made narrow and round in bottom $\frac{9}{5}$, so the metal will flow deep to fill the openings and keep the air from passing up; $\frac{9}{6}$ is ½″ deep only, but much wider than $\frac{9}{5}$, "it being directly under the pouring gate," to fill it quickly; for runner-box use two parts, the bottom one $\frac{9}{7}$ to protect the bars, and the top one $\frac{9}{8}$ as a cover to save both time, and the metal to fill a large open basin, which is objectionable for many reasons. The clamp $\frac{9}{9}$ for *medium* or *light* work is made from 1¾″ × ⅜″ Bessemer steel, the lower end $\frac{9}{1}$, forged with a pad to protect the bottom board; the sliding clamp $\frac{9}{8}$ of cast-iron cored taper on the back. For key $\frac{9}{4}$ use ⅝″ screw with about 5″ long, $\frac{9}{3}$, which with one hand can be set firm enough for any casting. The first cost would seem to be large, but to equip a foundry with them is much cheaper, as they can be adjusted to any height of flask and changed quickly from one position to another, so that a very few will answer when many cast or wrought ones of set lengths would be required, besides the certainty that they will be effective. The cross-bar $\frac{9}{2}$ and thumb-screw $\frac{9}{8}$ is a very cheap and positive way to hold the chaplet $\frac{9}{8}$ in position; there is no objection to the length $\frac{9}{6}$ to reach wider flasks, but if for large, heavy work to be weighted, they should be made with double bars to reach two or more chaplets, with adjustable pad and screw to avoid the uncertainty of wedges. There should be racks provided to hang the clamps on, which can be done at a very slight cost, and then kept in their place at all times when not in use, as well also as all other tools. There is no reason why a foundry can't be kept in as perfect order as a machine shop or other manufacturing establishment; the tools and other appliances for a foundry are costly, and the workman has no right to keep them in disorder or to destroy them.

[In the engravings which accompany above article on "Gating, Clamping and Securing Chaplets," the fractions $\frac{4}{3}$, $\frac{5}{8}$, $\frac{5}{9}$, $\frac{6}{5}$, etc., are used, referring to 4, Fig. 3; 5, Fig. 2, and other parts of the engraving in like manner.

By this method the use of the term Fig. 2 is dispensed with every time that cut is referred to. When describing a matter in which several cuts are used which must be referred to again and again, this method of reference seems to have a peculiar adaptation.]

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NEW YORK, MAY 1, 1886.

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Evidences of Mechanical Progress.

There are many evidences of recent progress in mechanical matters, and one needs to be a close observer to keep well informed of changes that are being made. Every line of manufacturing has its improvements, which must be observed from within, but there are not a few matters of mechanical progress that are plainly open to the public. He who travels by rail may notice that locomotives are being built heavier, and are drawing longer and more heavily-loaded cars; also that speeds of trains are increasing. The absence of clouds of smoke and cinders blowing into the faces of the passengers can be traced usually to the extension of smoke-boxes and better draft appliances, which are being adopted by most progressive railroads. As the traveler is whirled through the country after dark in an easy, comfortable seat on a car finished in artistic style, he observes that cities and villages, whose streets were formerly outlined only by rows of dim gas lights, have become brilliantly illuminated by clusters of electric lights on tall poles. The web perfecting printing press, that a few years ago was believed to be the very acme of mechanical skill in that direction, has been much improved, and, it is believed, will be brought to still greater efficiency. Higher pressures of steam are being carried both on locomotives and on marine boilers. Inside the shop, where master minds are planning these elements of progress, more powerful and efficient tools are being used in turning, boring and cutting metal than were to be had even a few months ago. Machinery is being devised to do what has almost always been done by hand in the foundry and the boiler shop. Mechanics who carefully study what has been achieved by others are the ones who participate in bringing about these progressive changes that are of so much value to the public at large.

Dead Stock.

Is there any other business in which so much waste is permitted by the accumulation of stock just too good for the scrap heap or cupola as in the average general machine shop? Around the majority of such shops old machines and parts and pieces of machinery are allowed to accumulate, when there is no probability of their ever serving any useful purpose—it looks like waste to break them up, is, nine times out of ten, the only excuse for their preservation. There seems to be an unwritten law against destroying anything around a machine shop that ever has been of service, so long at least as room for storing it can be found.

There are two lights in which this subject is worth considering. One is the unsightliness of such displays to those not accustomed to them; the old junk-shop appearance likely to lead customers to the belief that in some way it is indicative of the kind of work done in the shop. As between two shops in and around one of which these old machines and pieces are assembled, and the other the reverse of this, a new customer is morally certain to select the latter. The word machinist is somehow associated with something new and good, and not with dilapidated antediluvian surroundings.

The other way to look at it is the actual loss that can be computed in dollars and cents of carrying worthless stock of this kind. Some old piece of machinery that has stood in the way for twenty years, was at the beginning of that time worth twenty-five dollars for scrap. At the end it is worth considerably less, and the twenty-five dollars could have been used in the intervening time as a basis for doing a good deal of business. Old steam engines away behind any possibility of usefulness, are preserved for a customer that never comes, until if the money they were worth, at the beginning, to break up, had been allowed to accumulate at interest it would have reached a sum equal to the price of a first class modern machine.

A careful observation of the dead stock in and around a machine shop, and the application of a little arithmetic, will often reveal a leak that was not supposed to exist.

The Industrial Exposition at Cincinnati.

The managers of the Cincinnati Industrial Exhibition are to be congratulated upon discarding the award system this year and asking for articles of every kind to be entered for exhibition only. This plan goes into effect at the next fall (the thirteenth) exhibition, which opens Sept. 1st, and closes Oct. 9th. The competitive award system never worked smoothly and satisfactorily at any industrial exposition. It has caused no end of trouble and has produced hardly any good. In their circular the managers say:

While inviting attention to the rules of the first exhibition under the new system, the Board of Commissioners desire to state that the question of awarding premiums has been carefully considered, and we are convinced from the experience gained during the first series of twelve expositions, and which have been a continued triumph as mediums developing industry and art, that the time has arrived for a change. In many cases the awards are unwise and injurious to the rival competitors, and very frequently result in disappointment and dissatisfaction to the majority of the exhibitors. This exposition being the "inauguration of the new series," we have concluded, as the more prudent course to pursue, for all exhibitors to make their displays in conformity to the new rules, leaving the decision as to merit to a discriminating public, who really are the unbiased judges, and whose conclusions possess the greatest value to the exhibitor.

This is exactly the position upon the award question that the AMERICAN MACHINIST has advocated during the last four years. The annual exhibitions at Cincinnati have heretofore taken a front rank and this change will make them still more useful. They are not conducted as a private enterprise, but by a board of commissioners appointed by the Chamber of Commerce, the Board of Trade and the Ohio Mechanic's Institute. Goods will be received for exhibition on and after August 11th, and applications for space can be sent now. Machinery will be a leading feature of the display.

Personal.

We find the following item regarding Mr. Robert E. Masters, whose foundry articles have been received with so much favor by our readers, in the *Beloit* (Wis.) *Daily Free Press* of recent date.

Mr. Robert E. Masters, foreman of the Eclipse Wind Engine Company's foundry, of this city, has received the flattering appointment of manager of the Tredegar Foundries, Richmond, Va., one of the largest establishments in the country. In consequence of this offer he has tendered his resignation to the Eclipse Company to take effect when his contract with them expires in May. It was at the Columbus (Ga.) Iron Works, of which Mr. Masters formerly had charge, and at the Tredegar Foundries that most of the work of that class was made for the Confederate government during the late war. In all that relates to foundry work in its various details, Mr. Masters is thoroughly skilled, and his contributions to the AMERICAN MACHINIST on these and kindred topics have made him widely known among iron manufacturers. Many of his articles are extensively copied. In accepting his resignation the Eclipse Company compliment him in the highest terms on the capable and efficient manner in which he has conducted their interests. Before he assumed charge of the foundry, disturbances among the employes were quite frequent, but since he has had the management perfect understanding and good feeling have seemed to prevail. During their stay in Beloit Mr. Masters and his wife, formerly Miss Ida Black, have made many warm friends, who will sincerely regret to lose them from our midst and who will wish them all manner of prosperity in their future home.

We can say that Mr. Masters has received other offers of a good position on account of the reputation he has among foundrymen by his articles in the AMERICAN MACHINIST. He is a young man and believes in mechanical progress. Upon his resignation the Eclipse Company handed him a letter in which they say:

"Appreciating that you are capable of filling a much better position than we can give you, we submit to the inevitable, and only hope that we shall find in your successor one who will continue the same system, order, and general efficiency of our foundry force which you have maintained.

"Assuring you of our highest esteem, not only as an expert in your chosen calling, but as a gentleman, we remain, etc."

The recent accident on the Fitchburg Railroad, in which a train went down an embankment near Deerfield, into the river, the cars turning several times over in their descent, brought out in one instance at least the value of special training. In one of the cars was a brakeman who, in the perilous descent, was pounded from side to side of the car, severely injured and chilled by the water at the bottom of the embankment. The car broke in two, and the brakeman and a passenger similarly roughly handled made their escape. No sooner had the brakeman, bruised and bleeding, got on the bank than he instructed the passenger to take the track in one direction while he went in the other, to give notice of the disaster. It is this quality—the faculty of never being thrown off their balance—that makes up the real value of men engaged in such business as railroading. That brakeman deserves promotion at the hands of the railroad corporation.

The *Engineer*, of Glasgow, complains about the way the iron trade in England is "hampered by prohibitory foreign tariffs." The United States is of course the greatest offending nation. If, however, some of our "revenue reformers" in Congress had their way the hampering of the English iron trade would be greatly relieved. It would be done at the expense of our own iron manufacturers.

If the contract of Thomson Brothers, Clydebank, for the Spanish war cruiser is fulfilled, the vessel will be a remarkable one. We gather from *Engineering* that the vessel is to have a displacement of 4,300 tons, to be 300 feet in length, 50 feet in breadth, and 31 feet 6 inches in depth. The Messrs. Thomson guarantee that this vessel shall have a speed of 20½ knots per hour. No side armor is to be used, but she will have a complete steel deck below the water line, which is to be relied upon to protect the machinery and powder magazines. Space around the water-tight compartments will be filled with material of such a nature that if a shot passes through it will stop the hole. One of the requirements is that the vessel shall carry coal sufficient for steaming 5,000 miles.

The true mechanic seldom "gets stuck." The fertility of resource which he possesses is the effect of his being the good mechanic that he is. Give a man the job of moving a weight of several tons, and you can size him up by the way he does the work. The mechanic will construct his rigging with what material is at hand. He will do the job without fuss or delay, while some other man would be hunting for lifting appliances and running around after help.

A young steam fitter, in a letter of thanks, acknowledging advice in regard to learning steam engineering from books, says: "I am well aware that book reading never made a steam engineer, but I want to learn enough in that manner to enable me to make as good wages when I start in engineering, as I do now, for I must help my mother and the folks at home, so I will do my reading first."

A young man who looks so far ahead, and still looks out for his "mother at home," stands a good chance of making his mark.

Believers in the supremacy of gas are inclined to make merry over the fact that the electric light convention at Baltimore was held in a room lighted by fifty-cent water gas.

In spite of dullness in general business, building in New York, Brooklyn, Chicago and many other large cities is more active than for some years past.

Repair work in railroad shops, owing to the adoption of standard locomotives, is coming to be done, to a great extent, on the plan of duplication.

In the State of New Hampshire a number of manufacturing concerns work the "Granite State" for all it is worth. In a number of engine rooms the granite forms the floor. Anchor bolts are brimstoned into holes drilled therein, and the engine certainly has a solid foundation.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(184) O. M., Titusville, Pa., asks: What causes lard oil to separate into flakes, which stick to the side of the can, and stop up the spout, and what is the remedy? *A.*—We should think the oil was improperly prepared in the manufacture. We cannot name a remedy. Possibly thoroughly mixing a small amount of mineral oil with the lard oil may help matters.

(185) W. S., Cleveland, Ohio, asks: Is there any way to make the stroke of a piston longer without changing the crank of the engine? *A.*—Not in an ordinarily constructed engine. 2. I have a tank which a pipe will fill in 15 hours, and another pipe will empty in 20 hours, how long will it take to fill the tank while both pipes are open? *A.*—It is evident that in one hour, 1-15 the capacity of the tank would have been filled in, and 1-20 of the tank's capacity would have been removed, leaving 1-60 at the end of one hour, therefore 60 hours would be required in which to fill the tank under the conditions named.

(186) F. C. G., Charlestown, Mass., writes: What is the rule for correctly measuring the contents of a cylinder lying on its side and partly full, or how can I find the area of segment of circle, the radius and perpendicular being unknown? *A.*—To find the cubical contents of a cylinder as above first calculate the area of a section of cylinder, or, in other words, find the area of that part of a circle which represents the quantity of matter in the cylinder. This may be done by the table, "areas of the zones of a circle" in *Haswell's* pocket-book, and the area thus found, if multiplied by length of cylinder, will give contents. The area of a segment of a circle may be found be reference to table in *Haswell's* and other pocket-books.

(187) H. D., Seneca Falls, N. Y., will find directions for laying out cone pulleys in the AMERICAN MACHINIST of Oct. 15, 22, and Nov. 26, 1881.

(188) C. H. H., Matteawan, N. Y., asks for a receipt for making paste to stick labels upon smooth clean castings for shipping purposes. *A.*—A cheap shellac varnish will answer the purpose very well. Apply to the casting with a brush, then lay on the label and rub down with the same brush. By so doing a coat of shellac is applied to the surface of the label making a water-proof covering which effectually protects it from rain. 2. What is the black substance used for coating cast iron pipe such as is used in plumbing work, and which gives the pipe a neat and clean appearance? *A.*—Some pipe is dipped in a preparation of coal tar, but a varnish made of asphaltum is considerably used, which can be obtained from any dealer in paints.

(189) E. B., Charleston, S. C., writes: I wish to pump 25,000 gallons of water per day, 60 feet high, from a well 25 feet deep. Can this be done with a windmill, with an average speed of wind of ten miles per hour? *A.*—We should say you could. State your case to a maker of windmills and he will give you all necessary information. 2. Is there any rule for calculating the horse-power of a pump say 7" steam cylinder, 5" water cylinder, discharging water through 2½" pipe 60 feet high? *A.*—Pumps are rated by the amount of water they will handle, rather than by horse-power. You can readily calculate the horse-power required to raise water to any elevation by multiplying the number of pounds of water raised per minute by the height in feet to which it is raised, and divide by 33,000.

(190) J. B. Brooklyn, New York, asks: 1. What are the relative sizes of feed pipes for different boilers? *A.*—There is no rule in respect to this. The size of pipe is usually fixed by the pump or injector used. 2. In measuring boiler for horse-power is any part of the shell measured? *A.*—All the surface exposed to heat from the furnace is measured. In ordinarily set tubular boilers this usually includes not less than half the surface of the shell.

(191) J. W., Taylorsville, Ohio, asks: Which kind of riveting is best for a boiler, ¼" plate, ⅝" rivets; 1 mean of machine driven rivets, those driven by hand, or button set? *A.*—There is much controversy as to the best kind of riveting; we cannot undertake to decide; either style of riveting is used with satisfactory results.

(192) A. M., St. Paul, Minn., writes Given 6" pipe at surface of ground, pressure of water in pipe 40 pounds sq. inch, how many horse-power will it develope and how is the best way to use it? The supply is an artesian well 255 deep, water at surface spouts up from 6" pipe about 18". How high will this pressure carry water into the upper stories of buildings? *A.*—You do not give the quantity of water per minute, therefore we cannot calculate its power. By referring to the AMERICAN MACHINIST of April 3, Question and Answer 142, you will find a rule by which you can determine the matter for yourself. The water would rise under a pressure of 40 pounds to about 88 feet, in a pipe placed in a perpendicular position.

(193) Egypt, ——, Ill., asks why some taps and dies cut easier than others? *A.*—They do so for the same reason that some razors cut better than others, viz.: the cutting edge is in better shape and the construction is more correct according to mechanical principles. 2. When a tap is threaded on the lathe, should it be given any clearance? *A.*—All taps should have clearance. If cut in a common lathe, clearance must be given by filing. When taps are made in quantity, the tool is given a reciprocating motion by means of a cam, which forms the tooth with clearance; it is only necessary to cut the flutes in the right place. Pipe dies can be given clearance in the same manner when cut in a lathe, but when threaded by a hob the points only of the threads are given clearance and this is done by filing back with a round file.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Power measured.–F. Van Winkle, 22 Cortlandt, N. Y.

Alt, Mechanical Engraver on Wood, 318 B'way., NY

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philaddelphia, Pa.

"Morrison's Practical Engineer." A complete treatise (200 pp.) on steam and general mach. Mailed on receipt of $1. W. A. Morrison, Box 373, Lowell, Mass

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See April 3, p. 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Bound Volumes of the AMERICAN MACHINIST for the years 1880, 1881, 1882, 1883, 1884 and 1885. These volumes are strongly bound in cloth, and will wear well. Price $3.50 each; express charges additional. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. For sale by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES.

J. A. Esco, Crawford, Ga., will build a large shop in which to manufacture cotton planters.

The Bienville Water Supply Co. will probably build new water works at Mobile, Ala.

J. E. Masenhimer will erect a coach factory, two stories, 22x60 feet, at Manchester, Md.

Lima, Ohio, proposes to sell bonds and establish water works.

A new steel wire nail and tack factory will be started up at Sharon, Pa., within sixty days.

The Griffin cotton mills, Griffin, Ga., will increase their plant.

Warren Springer will erect two five-story factories 40x75 feet, at 214 to 218 Clinton street, Chicago.

The Arrow Steam Power Co., of Philadelphia, will erect a five story mill ,47x180 feet.

The Hall building at Saybrook, Conn., will be converted into a lock manufactory. D. C. Spencer and James H. Day are interested in the project.

The Trump Bros. Machine Co., of Wilmington, Del., will build an addition to their machine shop, 30x50 feet, one story, brick.

C. R. Clifford, Raysville, Ind., is fitting up a factory at Vanceburg, Ky., in which to manufacture grain cleaners.

The Pioneer Rolling Mills, at San Angelo, Texas, have let the contract for their new mill at $21,000. The daily capacity will be 100 barrels.

The Richmond & Danville Railroad Co. are putting some new machinery in their shops at Salisbury, N. C.

The Willimantic Linen Company has announced to its 1,600 employes that the 10 per cent. reduction in wages last year will be restored May 3.

Joseph M. Rhine, of Harrisburgh, Pa., is making the brick for a large cotton mill to be erected near York Haven, in that State.

It is reported that the Texas Pacific railroad shops will be moved from Big Springs to Colorado City, Texas.

Joseph B. Reed, of Cairo, Ill., is now building some lathes of a new pattern, which are soon to be put on the market.

Poole & Hunt, Baltimore, Md., are building a new boiler shop, machine shop and blacksmith shop.

A company has been organized with a capital of $225,000, and will occupy the Howe Machine Co.'s buildings in Bridgeport, Conn., for the manufacture of sewing machines of the Howe patent.

The plant of the Kentucky Rolling Mill Company, Louisville, Ky., has been purchased by Ewald Iron Company, of St. Louis. It its thought probable that the plant will be put in operation.

The Rollstone Machine Co., of Fitchburg, Mass., have issued list No. 11 of machinery manufactured and for sale by them. It is fully illustrated and will be mailed upon application.

A home company has been organized with a capital of $255,000 and will occupy the Howe Machine Co.'s building, Bridgeport, Conn., for the manufacture of sewing machines of the Howe patent.

The Pullman car shops at Pullman, Ill., have a contract for 100 passenger cars for the new Kings County Elevated road, in Brooklyn, N. Y. The cars will be similar to those now in use on the New York Elevated and Brooklyn Elevated roads.

It is said that E. P. Allis & Co. who own one of the largest manufacturing machine works in the West, at Milwaukee, Wis., have given notice that should their workmen insist upon observing the eight-hour rule, they (the firm) will shut down indefinitely.

The Plano Steel Works, of Plano, are being enlarged. Two new furnaces have been added, and the steam capacity increased by the addition of a 90 horse-power boiler. The works are running full time.

Citizens of Kalamazoo, Mich., have subscribed $2,000 bonus for the construction of a new street car line over the river of that village. Jerry Boynton has the contract and has gone to Cleveland to buy the necessary iron.—*Grand Rapids Morning Telegram.*

Gorham, N. H., is trying hard to secure the new shops and business of the Paris Manufacturing Company, lately burned out at South Paris. The town of Paris refused to exempt the concern from taxation for ten years, but voted to exempt for five years.

Thos. Brantly, Eufaula, Ala., has arranged with the Barlow Machine Works, of Eufaula, to manufacture his high-speed engine. The engine, we are informed by the inventor, has no piston-rod, guides, cross-heads or stuffing-box. It should be added that it is not a rotary engine.

During the past month Beaudry and Cunningham, of Boston, Mass., have booked orders for upright cushioned power hammers from the following parties: John Russell Cutlery Co., Turners Falls, Mass.; Carrier, Laine & Co., Levis, Quebec; Cleveland Hardware Co., Cleveland, Ohio; Wheeler, Madden & Clemson Mf'g Co., Middletown, N. Y.; Globe Seat Co., Columbus, Ohio.

We have received a copy of catalogue No. 2, published by Chas. A. Strelinger & Co., Detroit, Mich., dealers in tools, supplies and light machinery. It is a 260 page publication, well illustrated and neatly printed. The latest and most approved tools are represented for machinists, engineers, founders, model makers, blacksmiths, amateurs, and all manufacturers. Price lists are given in most cases

The Guild & Garrison Steam Pump Works of Brooklyn, N. Y., have issued a new catalogue of their productions, consisting of piston and plunger pumps, vacuum pumps single and duplex, air and gas blowers, high-speed air compressors, and other machinery in the same line. All work is thoroughly tested and fully warranted. The catalogue is well illustrated and neatly bound.

J. H. Sternbergh, proprietor of the Reading Bolt and Nut Works, Reading, Pa., will erect three new shops. The largest building will be a machine shop, 60x50 feet, and five stories in height. A smith shop will also be erected and supplied with the most improved furnaces and tools for working and shaping steel. Another brickstructure, 19x35 feet, will be built for the grinding and tool department.—*Industrial World.*

F. E. Dustin, of the Dustin Manufacturing Company, has lately returned from a trip to various machine shops in Massachusetts and Rhode Island. He reports business greatly interferred with by the Knights of Labor agitation. He says employers are not willing to take contracts in the present uncertain state of the labor question, and are proceeding very cautiously in business ventures.—*Dexter Gazette.*

The organization of manufacturers in the various industries is being quietly pushed, but it shows good prospect of having considerable attention paid it as the plans of the originators mature. Delegates have been elected during the week to attend the national convention of employers, in Chicago, next month, where some programme for organized effort will be agreed upon.—*Boston Commercial Bulletin.*

The New York Sleeping Car Company is about to build shops at Buffalo, N. Y. The company has about 400 acres in service, and is arranging facilities at East Buffalo for building eighty cars at a time. From 1,600 to 2,000 mechanics will be employed. The most important of the buildings to be erected is a car shop 700 feet long and 100 feet wide. The shop built by the West Shore Road will also be used by the company. Six buildings are to be erected.

A new axe and shovel factory is to be erected at Braddocks, Pa. The capital stock of the new company will be over $100,000 and work will be commenced on the new building within a short time. The chief stockholder and general manager of the concern will be Thomas Bakewell, formerly of the firm of Bakewell & Hubbard, axe and shovel manufacturers, Pittsburgh, Pa. They have plans prepared for two buildings, 48x108 feet, connected by a center building, 24x120 feet.—*Iron Trade Review.*

A number of capitalists and business men of Sharon, Pa. have formed a company for the manufacture of steel wire nails, small tacks and other like products, and expect to begin operations within sixty days. The old brass and iron factory near the Sharon Stove Works has been leased for the purpose. The machines are said to be of a new pattern, and the invention of a member of the firm, Joseph Higgs. The capacity at the outstart is estimated at thirty machines. S. C. Simonton, Jr., will be manager and Joseph Higgs superintendent of the works.

Watson & Stillman have removed their machine shop from 470 Grand street, New York, to 208 East 43d street. They have acquired all the tools, patterns, drawings, etc., of the late Wm. Munzer, and have consolidated the shops, tools and business. Their specialties embrace hydrostatic machinery, presses, accumulators, jacks, pumps, punches, valves, fittings, patent punches and shears, straight lift elevators, polishing and buffing machinery, wood wheels, etc., improved Corliss engines, Baxter cut-off engines, portable engines, hoist engines, mash machines, barrel washers, malt scourers, keg elevators, grain valves, 14 and 18' lathes, etc.

F. C. Linde & Co., manufacturers of locks and bronze hardware, South Norwalk, Conn., employing about 100 hands, will remove to Cresskill, N. J., in July next, their present accommodations being altogether too small for their rapidly increasing business. Their new quarters will be a brick building 90x40 feet and four stories high. They will also erect a brass foundry 82x32 feet which is intended to be a model of its kind. The shop will be fitted up with new machinery of the latest improved pattern. There is a 40 horse-power waterwheel and an 80 horse-power engine in the building, which can be run separately or connected.

Frank & Co., Buffalo, N. Y., write us: "We are at work at present on a narrow planer and matcher that we expect to beat or at least equal any planer made in the amount of work that it will do, and at the same time, supply a planer at a very much lower price than anything in the market of equal capacity and durability. We are also at work on what at first sight would be considered a foolish attempt, that is a light running machine to be worked by hand or man power. We have had many inquiries from Spanish countries, but have until now refused to build any thing of the kind. We had quite a prolonged conversation with a man who has traveled in the Spanish countries, and from what we learned from him, think such a machine would sell well."

Machinists' Supplies and Iron.

NEW YORK, April 15, 1886.

The market has been without change. The demand has been almost entirely of a retail character, and buyers are conservative.

Iron—In American pig the week's business has been very unsatisfactory. No. 1 X, Foundry, at tide water, $17.00 to $17.50; Standard, Lehigh and North River, $18.00 to $19.00; Grey Forge, $16.00 to $16.50.

Scotch Pig—Quiet and steady. Coltness, $20.25 to $20.50; Glengarnock, $19.50; Gartsherrie, $19.50 to $20.00; Summerlee, $20.25.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Foreman for boiler shop. Adolph Leitelt, 5 Erie street, Grand Rapids, Mich.

Wanted—Position as foreman pattern-maker; first-class references. Address Box 6, AM. MACHINIST

Wanted—By a first-class machinist and draftsman, a position as draftsman; correspondence solicited. Address Myron, AM. MACHINIST.

A practical draftsman and designer and thorough mechanic desires a permanent position as draftsman or tool maker. Address, Steady, AM. MACHINIST.

Foreman wants a position in a machine shop, understands all kinds of dies and cutting tools. Joseph A. Bouillard, Bristol, Conn.

Experienced supt. of machine works wants situation where good management will count. Heavy work preferred. Address, H. B., AM. MACHINIST.

Wanted—A position as foreman boiler maker. Can furnish the best of reference as to character and ability. Address, R. C. R., AMERICAN MACHINIST.

Wanted—A competent man to manufacture fulminate of mercury and load cartridge primers. State age, experience, etc., with expectations. Address, box 7, AMERICAN MACHINIST.

Permanent situation wanted by a practical machinist, good lathe and vise hand. N. Y. city preferred on account of studies. Address, Progress, AM. MACHINIST.

Engagement wanted by a contracting engineer of large experience in iron construction and steam machinery, Recently Chicago manager of a prominent steam engine business. Address, C. S. D., 218 La Salle street, Room 830, Chicago, Ill.

Toolmaker of 12 years' experience on machine tools, sewing machines and watch machinery, desires to take charge of tool room or make all tools needed in small shop. Has run tool room in large eastern shop, satisfactorily. Refers to last employer regarding ability and character. Address, Tools, No. 125 4th Avenue, Cleveland, Ohio.

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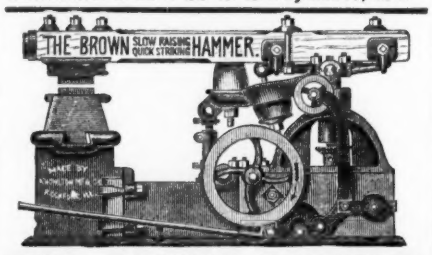

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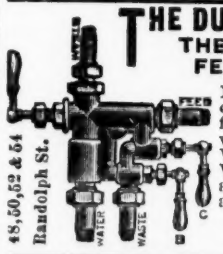

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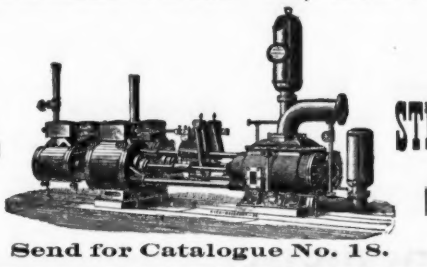

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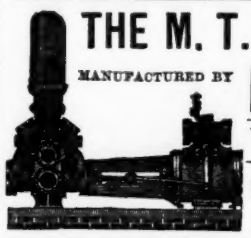

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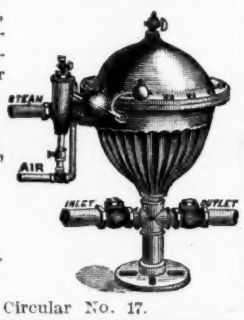

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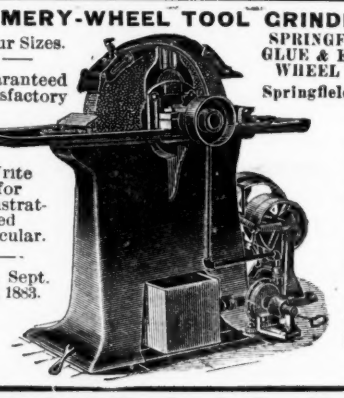

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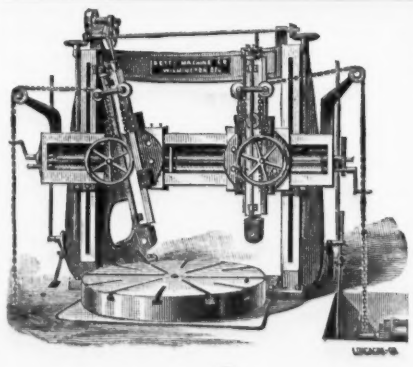

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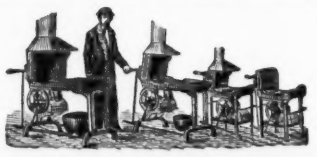

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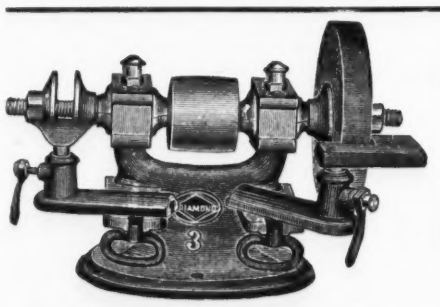

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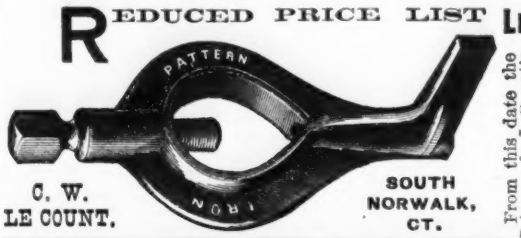

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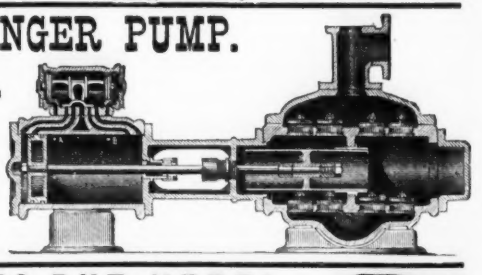

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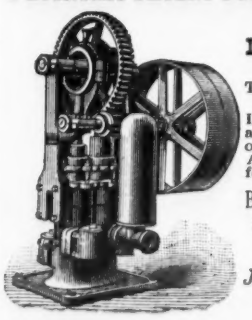

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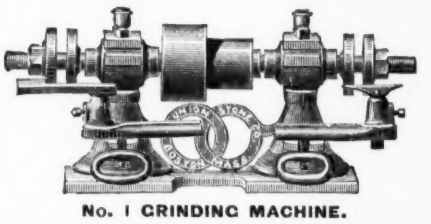

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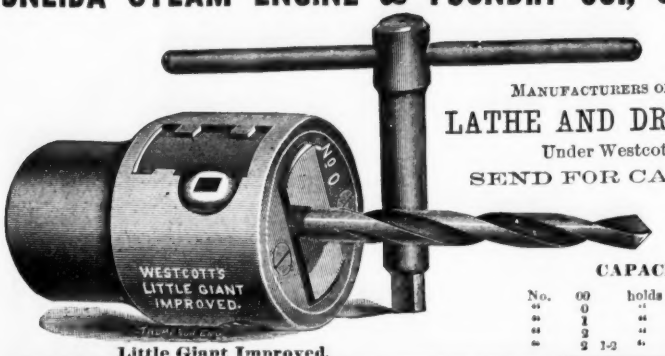

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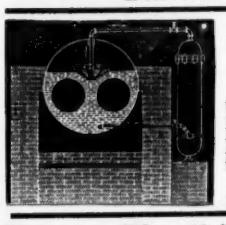
"	2 1-2	"	0	to	1



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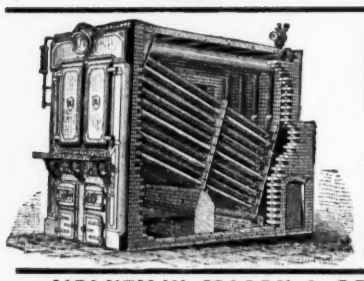

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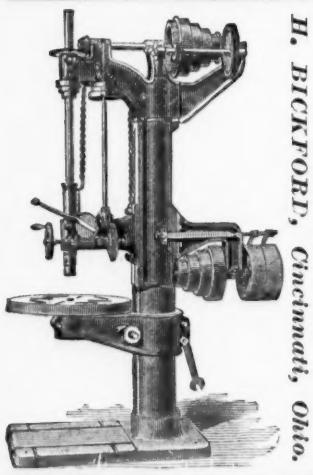

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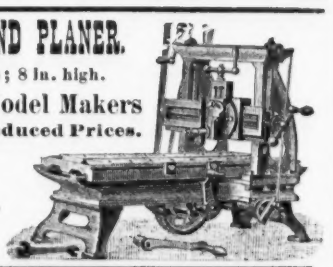

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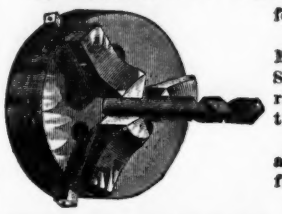

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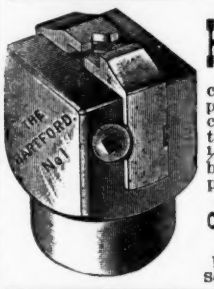

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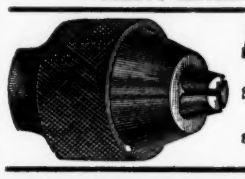

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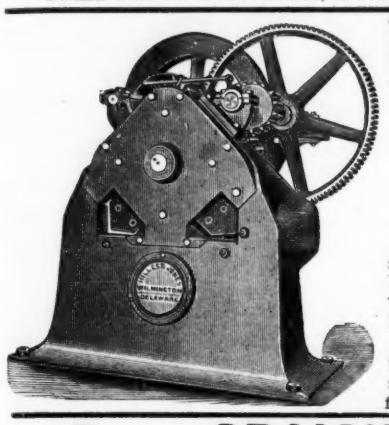

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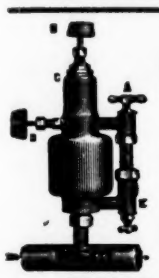

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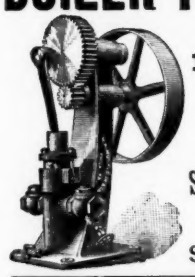

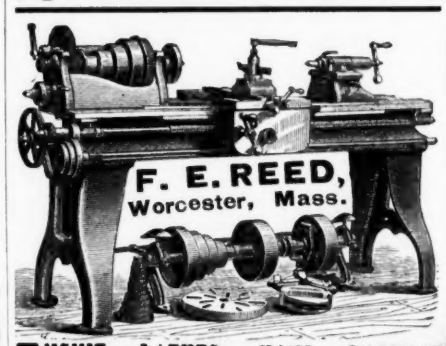

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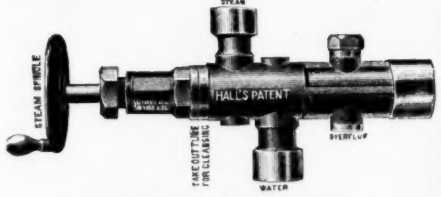

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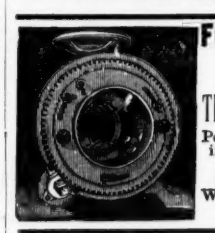

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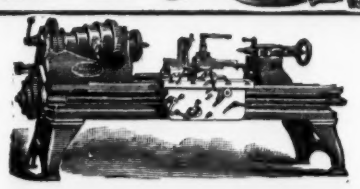

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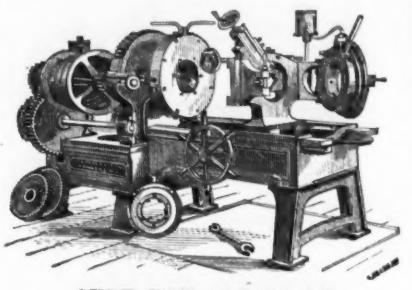

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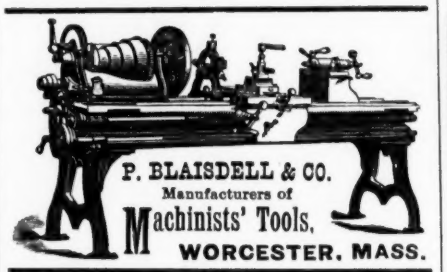

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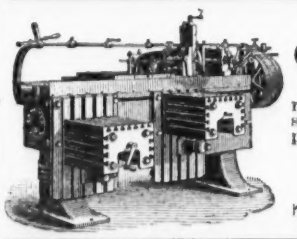

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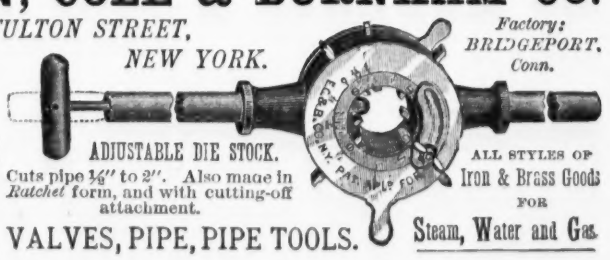

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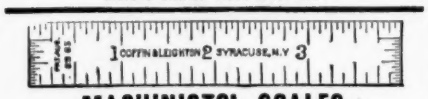

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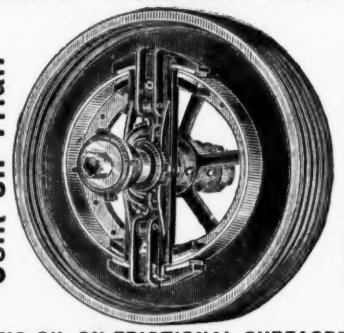

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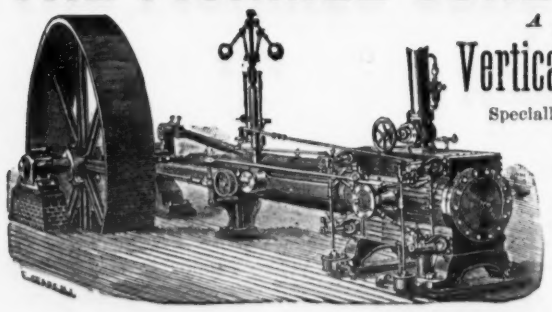

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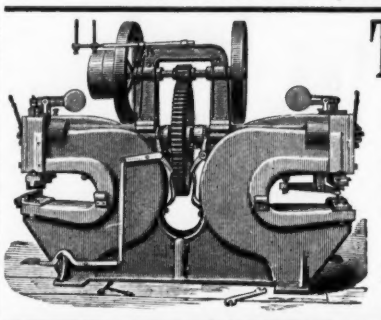

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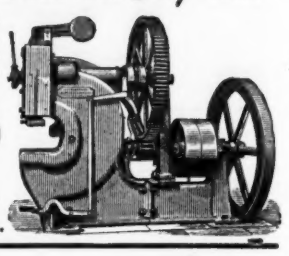

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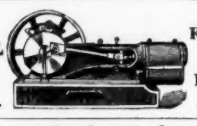

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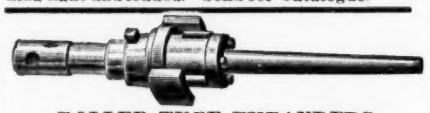

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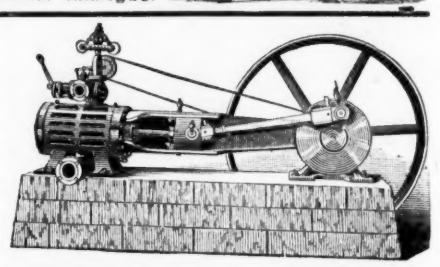

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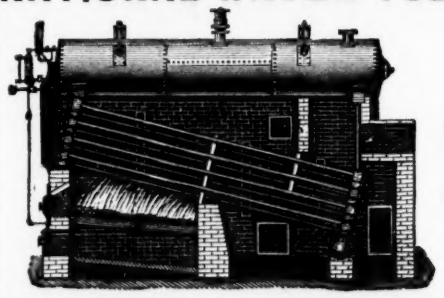

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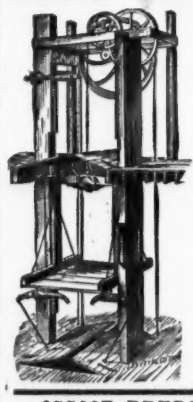

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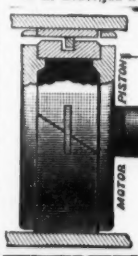

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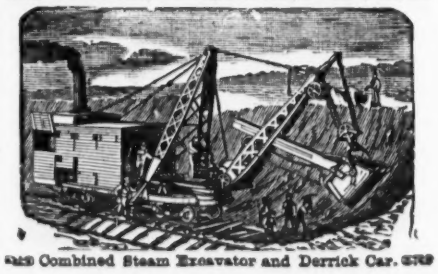

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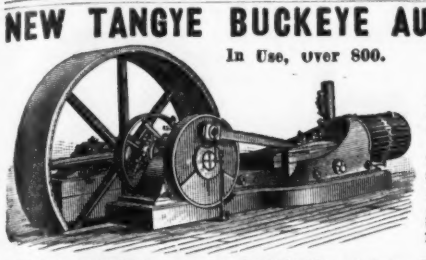

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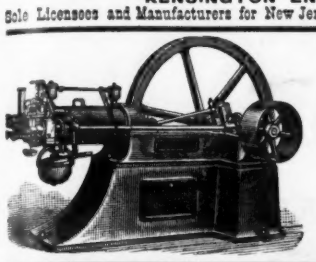

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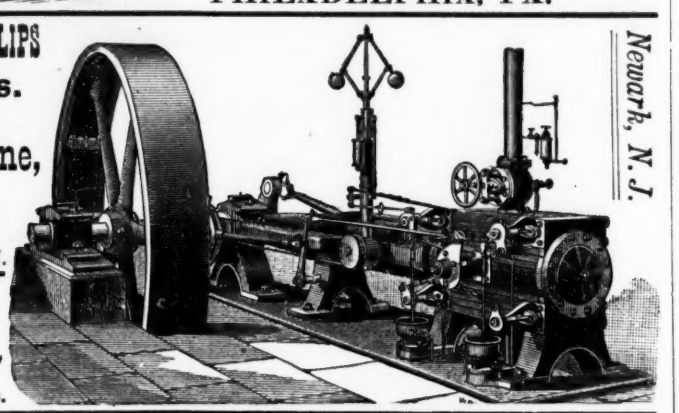

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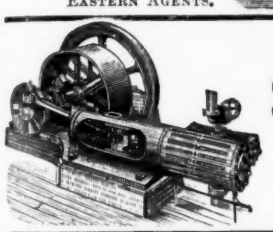

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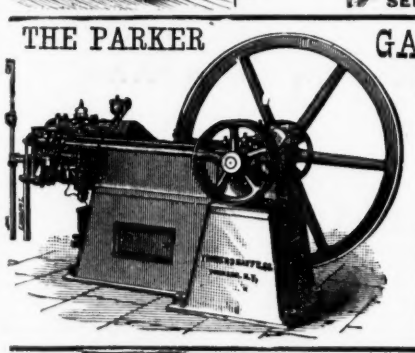

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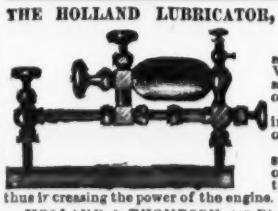

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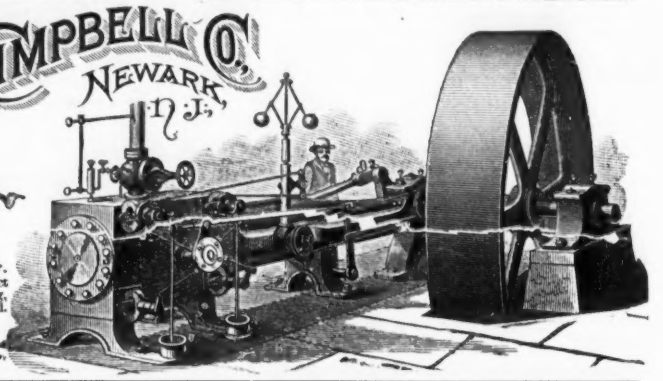

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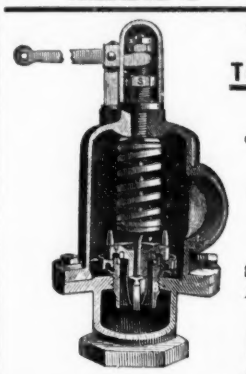

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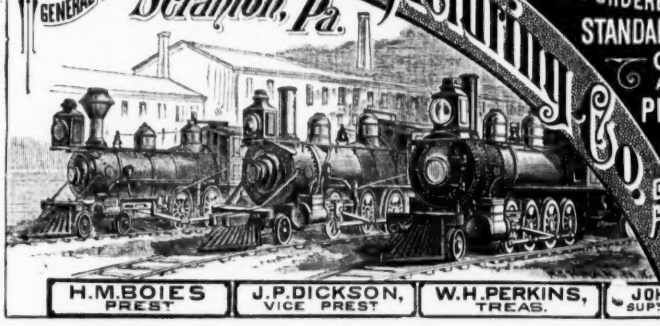

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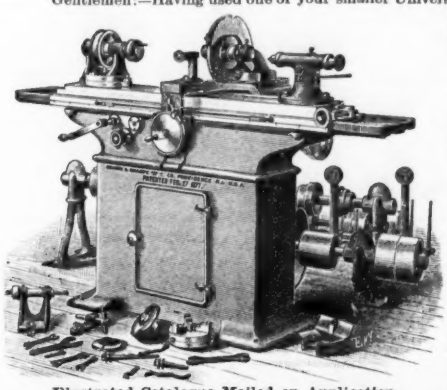

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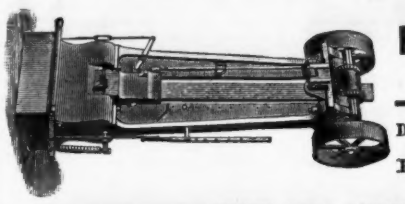

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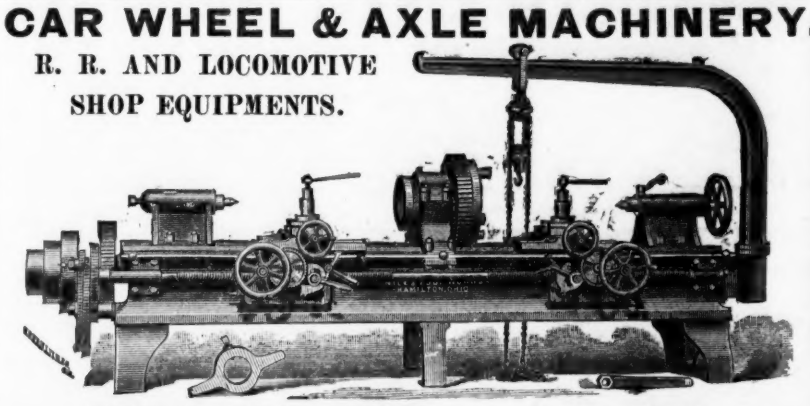

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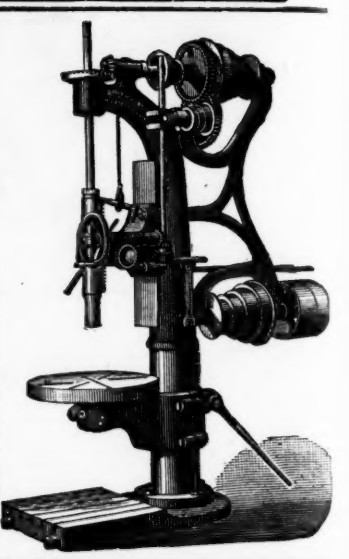

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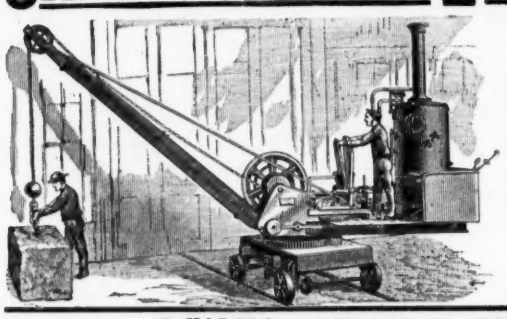

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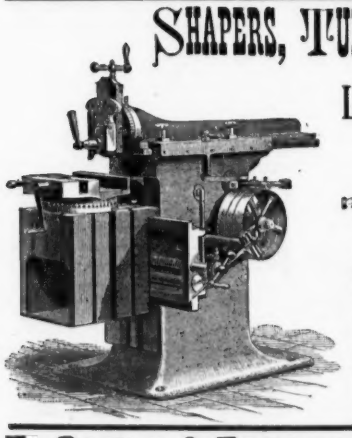

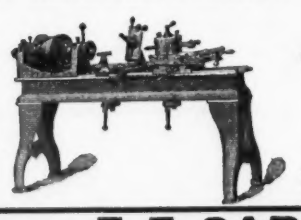

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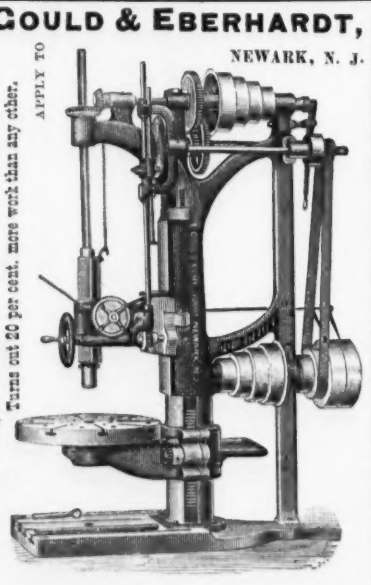

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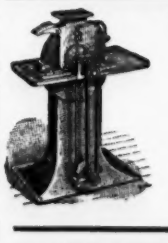

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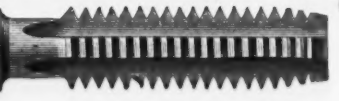

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